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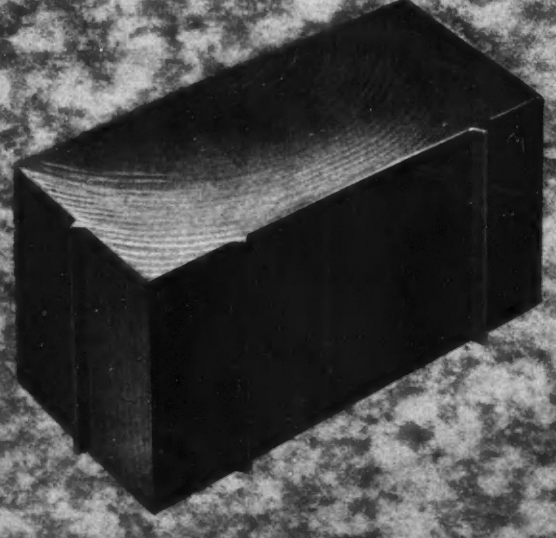

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN *Editor*

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Railway Working Agreements

LAST week the Railway Labor Board refused to entertain the request of the railway executives that the war-made working agreements be set aside. The request was denied because, in the judgment of the board, the matter fell within the jurisdiction of the Interstate Commerce Commission, the reason for the request being that the working agreements made it impossible to earn the net return aimed at in the Transportation Act. Presumably, therefore, the question of the agreements will come in for a full airing before the commission. In any event the injection of them into the Chicago hearing has served to direct toward them the attention of the public. The information offered, though, is far from adequate. It has barely served to whet the public's appetite. What is needed is clear and convincing evidence of the effect of these agreements. The public is ready to lend its support to any movement aimed at getting back, in all lines of endeavor, to payment by results. Moreover, the railroad problem is the public's problem. The public, through its agents, forced upon the railroads these agreements. The public, through rates, must pay the bill. What more logical than that the public be given the facts?

It should be remembered, too, that the public's attitude toward the railroads is now a fair one. Little protest was made to last year's rate increases, while the improvement in service was highly commended. Repeated statement is necessary, of course, to awaken a large number of people to the meaning of such a situation as that which confronts the railroads but the public's attitude is certainly receptive.

Non-Partisan League Experiments

NORTH DAKOTA has been in the public eye for some years as an experiment ground for state operation of functions generally discharged by private corporations. Controversy has raged over the merits of what was being done. Those socialistically inclined were loud in their praises. Others saw dangers and predicted ultimate failure. Even now the experiments cannot be said to have reached a conclusion but the failure of the state-owned and operated bank, the Bank of North Dakota, is probably the beginning of the downfall of some of the other state-operated institutions. It will undoubtedly be claimed by those who seek escape from the shortcomings that attach to private ownership that public operation cannot be expected to produce its full results when surrounded by the enmities of those who favor private ownership and management. That sort of claim, of course, is always made when governmental ventures fail. The outstanding fact is, however, that no matter what the theoretical merits, these socialistic experiments have a habit of getting into trouble. In this regard North Dakota's experiments are "running true to form." Some day the millennium may come but it seems still to be very far away.

What of Business?

NO QUESTION today is more often asked than, What of business? There is little activity in engineering lines. Do we face a dead year? Will there be a revival in the spring, or in the late summer? As we set forth in the first issue of the year, *Engineering News-Record* takes a relatively optimistic view of the situation. As there explained, conditions are more favorable for construction than for some years. Materials prices have receded somewhat, labor is more plentiful and more efficient, transportation promises to be better than last year. As yet, however, there are not definite signs of what the spring will bring. It is worth noting, though, that the volume of contracts let in January of this year compared favorably with that of January of last year, except as to buildings (see last issue, p. 279). Moreover, we know that much highway money is available. That much of it will be used seems very certain. The New York State opening of bids week before last should be an encouragement. On twenty contracts advertised there were 83 bidders, and the low bids were well under the engineer's estimate. Pennsylvania this week receives bids on 104 miles of road, and the results there will also furnish some index of what can be expected from highway bidders. In other lines of public works evidence of special activity is not yet apparent, but with conditions favoring more economical construction than for some years we are still hopeful of a considerable revival within the next three months.

An Adverse Report

OLD acquaintances confront us in the crucial factors of the Long Beach dome collapse: high stress, and lack of bracing. The combination has often been fatal. In most cases where high stress has figured as a cause of failure—possibly in all—there was also a lack of adequate bracing, and so we may call lack of bracing the chief factor here. A substantial piece of steelwork, stiff in all its details, has rarely or never failed. These things are fairly well appreciated. Yet, according to the report printed on page 294, one engineer was so far oblivious of them as to erect a ponderous concrete dome on a square of slender trusses unbraced except by flexible web hitches; and an architect and a board of church officials were foolhardy enough to build to this design in the face of an adverse report. Surely, on some or all of these parties rested a responsibility weighty enough to prevent the faulty construction. So far as it rests on engineers, we are making progress in fixing such responsibility and making sure that they are competent to bear it. License laws and joint action through societies will accomplish this result. But how about the responsibility of the layman? When we have made engineers fully responsible to the community, must there not be a reciprocal responsibility? Shall an architect, or a board of church trustees, be free to disregard an engineer's adverse report?

Structural Effects of Vibration

UNLIKE most structural failures the collapse of the Strathmore apartment house in New York on Dec. 1 has been found due to a group of minor possible causes acting in co-operation rather than to a single controlling cause. The report of the superintendent of buildings, noted on p. 315, absolves the reconstruction operations from direct blame and lays chief responsibility on the loose, unbonded structure of the building, involving brick masonry in shattered condition and joists that were not anchored to the masonry but merely rested on corbel courses. It is interesting to note the emphasis placed on lack of anchorage, in connection with the description of the structure given in *Engineering News-Record* of Dec. 9, p. 1155. In fact, the possible wedging away of the heavy but shallow and flexible floors from the walls was suggested in early discussions of the failure. Perhaps the most important item of the report, however, is its mention of vibration as a probable factor in the failure—evidently referring to vibration set up by traffic near the building. The adjoining streets are paved, and heavy vehicles pass frequently; a double-track street railway and a four-track subway line pass the Broadway front. That paved streets set up perceptible tremor of the ground is within everyone's experience. In bad cases such tremor may be felt within buildings, and, though representing an extremely minute range of motion, it has an obvious potentiality for harm to poorly bonded structures. While specific cases of injury to buildings from traffic vibration have not been reported, it is to be remembered that heavy truck traffic is a matter of relatively recent growth. But the effect, if there is any, is bound to be a continuing one. It is therefore a strong added reason for providing thorough bond between the several parts of a structure. With respect to existing buildings, it may be well to watch for any appearance of "opening up" of joints between structural parts, and take steps to check such disintegration if it appears.

Pavement and Rail Tremor

AS TO the effect of rail traffic in setting up earth tremors like those noticed at the passage of a heavy truck, little seems to be known. Street-car traffic, of course, is directly comparable with pavement traffic, and rail joints with roughnesses of the street surface. On the other hand, rapid-transit subway traffic generally produces small surface effects—at the worst points only very slight tremor compared with that set up by street vehicles. Below the surface the comparative effects may be different, since street-traffic tremor is probably a superficial action, while a vibration set up by subway traffic originates at some depth and may therefore pass into building foundations lying above track level. With respect to buildings the subsurface effect obviously is the more important. Present experience, which is all negative and only of limited amount, seems to acquit rapid-transit subways of any charge of injurious effect by sending out vibrations. In view of the novelty of the point raised in the Strathmore report, however, it is only fair to remark that we know next to nothing about the effects of either pavement or rail-traffic vibration. On the basis of past experience, neither would be suspected of possible destructive effects on buildings. In any event, however, it may be set down as axiomatic truth that well-bonded construction has nothing to fear from vibration of either origin.

Drainage Development an Open Field for Engineering Societies

IN THE IMPORTANT field of improvement and reclamation of agricultural land by drainage and flood protection, the engineering societies of the central and southern states have large possibilities which thus far have been little realized. These societies do deal to some extent with the technical, legislative and agricultural aspects of drainage. Many of them have drainage sections or committees. Most of their work, however, is confined to the consideration of papers and reports at meetings, and the occasional passage of resolutions relating to legislation, with infrequent support of measures before legislative bodies. The activities of such societies, also, are individual rather than co-operative. A society rarely lends active aid to its drainage committee and the societies do not combine their work or influence. The germs of action are existent but dormant.

In furtherance of land drainage there is much need of education to show the value of co-operative construction and maintenance, and the need for better drainage laws. Co-operation is needed in securing concerted action by landowners in a drainage area and in promoting harmonious relations between the authorities of small adjacent districts, so that even if the drainage systems are carried out separately they may form parts of a large interconnected system or at least not be injurious to one another. In such cases there should be active co-operation on the part of the several engineers.

Many local drainage authorities are badly in need of education as to what drainage engineering means. Except in the case of large projects the engineer is often looked upon as a necessary evil or as a skilled hired man who sets out ditch lines. The rural engineer, however competent, has little time or opportunity for educational work.

Again, maintenance of drainage ditches is so generally overlooked or neglected that it may hardly be said to exist, except on some large projects. The engineer seldom has connection with a project after it has been completed, and though he may point out the desirability of keeping ditches clear his advice is rarely taken. In later years, however, when the ditches silt up and fail to carry off the water in wet seasons or floods, the landowners may lay the blame upon the designers.

As to drainage laws, they are defective and cumbersome in many states, but as a rule attempts to revise them have to face the double disadvantage of a strong opposition and an indifferent or even divided support.

Along these lines—co-operative action, ditch maintenance and improved legislation—as well as the broader lines of land reclamation as a local and national benefit, much assistance may be given by local and state engineering societies, perhaps in co-operation with farmers' institutes and similar organizations. All such work would be part of a needed campaign of education on the essential requirements as well as the prospective results of land drainage. Such work, too, would give support to the work of individual engineers and help to prepare the ground for further projects. But the campaign must be carried on continuously and in the face of discouragement and opposition, recognizing that the ultimate results will be highly beneficial to the profession, to the communities and to the country at large.

Which of the state engineering societies will lead in opening such a co-operative campaign in the interests of professional and agricultural development?

Permanent Bridges

IF THE popular term "permanent bridges" applied to stone and concrete structures is considered in the light of some recent failures of arch bridges its propriety is bound to appear somewhat doubtful. Experience shows that such bridges are not always permanent. For example: Two small arch structures in an Eastern state recently failed, one when just completed and one shortly after completion; in the far West a bridge over an important river failed when only six or seven years old; and finally the recent failure of the Third St. bridge at Dayton after sixteen years' satisfactory existence is to be considered. The latter is not yet fully explained, though it is significant that there was extensive disturbance of stream conditions by the hand of man, which was likely to set in action external forces of destruction. But with respect to the other bridges mentioned, normal natural forces worked unaided; in two cases the foundations scoured out, in another the chief blame must be laid on the superstructure. Engineers are bound to recognize that such occurrences imply a serious limitation on the qualification "permanent."

The public conviction as to the propriety of the term "permanent" is quite logical, however. Since the material is virtually everlasting—*good* stone and *good* concrete are referred to—structures built of it should realize this quality. If the engineer does not succeed in making his structure permanent the fault is his. What more natural, then, that bridge failures of the kind mentioned should be laid at the door of the engineer? He, or his profession, is charged with lack of skill, or with negligence. But the engineer himself is partly responsible for having the public blame him, since, knowing that some failures of this kind will happen, he yet has encouraged the view that stone and concrete bridges are inherently permanent.

One or two points bearing on the question need to be thought of. The manner in which foundation problems are involved was suggested in these columns last week. If foundations are not always permanent, then also the structures which they carry can not be considered permanent. We will not be fully justified in calling a bridge—or any structure—truly permanent until we construct our foundations of such unquestionably rugged character that they will resist the tooth of time and the infinitely varied attack of nature.

But it must also be remembered that the popular "permanent" bridges commonly involve arch construction. We incline to forget the old warning that the arch never sleeps, yet time verifies its truth again and again. Especially in the great present-day preference for arch structures it is well to bear in mind that the continuous distortions and movements of bridge arches and their piers may not in every instance be harmless. Experience has proved that stone arches have very long life (though all our conclusions are based only on those structures that have survived). Suppose we assume that this is equally true of arches constructed of perfectly made concrete, on rigid foundations. It may not be true where concrete of commercial grade, or somewhat below this grade, is concerned. To what extent the constant movement of the arch will take advantage of the slight imperfections of concrete that are apt to occur in most structures we do not yet know; but we do know that stone arches because of their voussoir construction can adapt themselves to slight distortion, and that concrete arches probably can not. Only experience of some length of time can tell us how far the adjective permanent must be qualified in its application.

In fine, it seems a proper caution, in applying the term "permanent" to concrete and stone arch bridges, to refrain from interpreting the term too rigidly. We should not believe, nor must we lead the public to believe, that such structures are proof against all the vicissitudes of an indefinitely long existence. It is a fact that they will be the more truly permanent the more carefully the engineer and the constructor foresee future contingencies. But a chance for deterioration or failure will always remain; it may be classed under the heading of insurance or under that of maintenance, but under either name it puts a measurable upkeep charge on the bridge besides (statistically speaking) limiting the life of the structure and making it something *less* than everlasting.

My Right-Honorable Opponent

WHY do engineers so frequently harbor personal feelings toward those with whom they disagree on technical matters? That was the question put recently when after the adjournment of a meeting in which there had been sharp discussion it was apparent that personal animosities still persisted. The speaker added that engineers should cultivate the habit of lawyers of being able to argue subjects with the utmost earnestness and, immediately thereafter, lunch together on entirely friendly terms.

The question and the comment are well worthy of the consideration of engineers. We do not know whether engineers are more sensitive regarding disagreements of opinion than are other classes of individuals, but if they are we can readily see why this might be so. An engineer is accustomed to dealing with facts and with immutable natural laws. He feels instinctively that there is about everything a definite position that must be right; what differs from it is wrong. Following the usual course of human failings he is inclined to consider his own analysis and conclusions as correct, and, applying his rigid standard, is likely to suspect the honesty of one who espouses a different view.

Of necessity, there is a right and a wrong to every problem, but the difficulty is that most problems are so complex that our feeble human brains are unable to tear them apart and with absolute correctness appraise the value of each factor. Even where the separation into elements has been made the interpretation of the applicable standards rests upon individual training, experience, and prejudices. What wonder then that on even simple questions there should be a variety of views!

Engineers are no exception to the fallibility of human nature. Some of their problems are subject to exact mathematical determination, but by far the greater number of them call for the application of the standards of individual experience, in other words, of judgment.

We need, therefore, to realize that the other fellow may have as good ground as we for his conclusions, and to derive from that reflection an attitude of tolerance—and respect—for opposing views. Above all, we need to regard problems as objective, and to refrain, unless the grounds are appallingly clear, from imputing motives to our opponents. Let there be fair, even strenuous discussion, but let the personal relations be in no wise disturbed.

Allegheny River Bridge Reconstructed at New Grade

Baltimore & Ohio R.R. Crossing at Pittsburgh Replaced by New Structure of Longer Spans at Higher Elevation—New Side Span Raised 15 Feet When Channel Span, Built at New Grade, Is Rolled In

A DIFFICULT piece of bridge replacement, involving several series of operations of rolling and jacking heavy spans, was successfully completed on Dec. 20, 1920, when the new Allegheny River bridge of the Baltimore & Ohio R.R. at 33rd St., Pittsburgh, was put into service. Unusual complications controlled the planning of the work, as described in *Engineering News-Record* of Nov. 4, 1920, p. 904. It was necessary not only to replace the bridge piecemeal by rolling in successive spans at different times, but to build part of the new structure at the old grade and part at the new grade, in order to maintain traffic. The final work, carried out in a single traffic interruption of 19 hr., involved three simultaneous operations: (1) Replacing two old spans of 245 and 157 ft. by a single 434-ft. channel span with a 75-ft. approach girder span coupled to it; (2) setting several approach spans, and (3) raising a 261-ft. truss span through a height of 15 ft. from the old to the new track elevation. The latter was the slowest and probably the most hazardous item of the day's work.

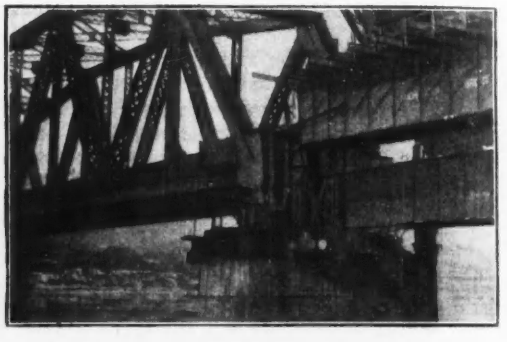


FIG. 1. FINAL REPLACEMENT OF BALTIMORE & OHIO R.R. ALLEGHENY RIVER AT 33RD ST., PITTSBURGH

Looking upstream before rolling of channel span — East end of 261-ft. span during raising to new track grade

Among the complicating factors in the renewal of this bridge were change of span lengths and elevation of bridge (under orders of the War Department) the requirement that the river channel be kept open for navigation, the necessity of building the new structure on the old alignment because of property conditions, and the impossibility of arranging for detour tracks on the east bank where the approach viaduct passes through Thirty-third St. Raising the grade had therefore to be carried out on one track at a time. Due to the necessity of keeping the river open, the bridge had to be replaced span by span, and in this work the difference of new and old span lengths made it necessary to introduce a short temporary connecting span at one point. Further, the new piers, which had to be built under the old bridge, could not be caried up to final elevation, so that in shifting the new spans to place they had to be landed on temporary supports on the uncompleted piers. The 75-degree skew of the river spans and varying skews of the west approach, and the interference of the west approach detour track with the renewal of this approach, also helped to make the problem intricate.

The design of the new bridge was shown in the article already cited. One of the illustrations of that article is reproduced herewith as Fig. 2, to show the condition of the river spans before the final operation. It explains the interrelation of the two major items of the operation carried out on Dec. 20, namely, the rolling of the channel span and the jacking of the 261-ft. side span.

Prior to Dec. 20 the whole bridge was operating at its old level, but only the westbound track was in service, as the eastbound track of the Thirty-third St. viaduct (at the right hand in Fig. 2) was being raised to take traffic at the new grade after the final change of the river spans. The two easterly spans of the four-span old structure had been replaced on Sept. 1 by a new 261-ft. truss span and a plate-girder span of 95 ft. 8 in., erected on falsework alongside the bridge at the old track grade and rolled into place, pushing out the two old spans; simultaneously, a pair of plate girders was put in position at the west end of the new work to span the gap between the new pier C and the old pier 3, as indicated in Fig. 2. From the west end of the old river bridge the westbound track deflected to the right, reaching a detour alongside the approach, while the new approach viaduct was being erected on the final alignment. This viaduct was built complete up to within three spans of the river bank, which spans had to be left until the day of the final change on account of interference with the detour.

The new channel span was erected at the elevation of the new track. Steel bents were provided to support it on the new piers after rolling, these piers being about 14 ft. below their final height. As the shoe plates of the new span were a little below rail level of the old spans, it was possible to set in place the bent on pier C without fouling the track. At the other end of the span, however, pier D was located under the old structure, so that the pier bent could not be erected; it had to be built on the falsework as part of the new span and moved to place with it. Because of this difference the sketch, Fig. 3, of the rolling arrangement at pier C does not apply directly to pier D, where the rollers were under the shoes of the pier bent instead of under the shoes of the span.

In conjunction with the raising of the eastbound track of the viaduct in Thirty-third St. the half of the girder

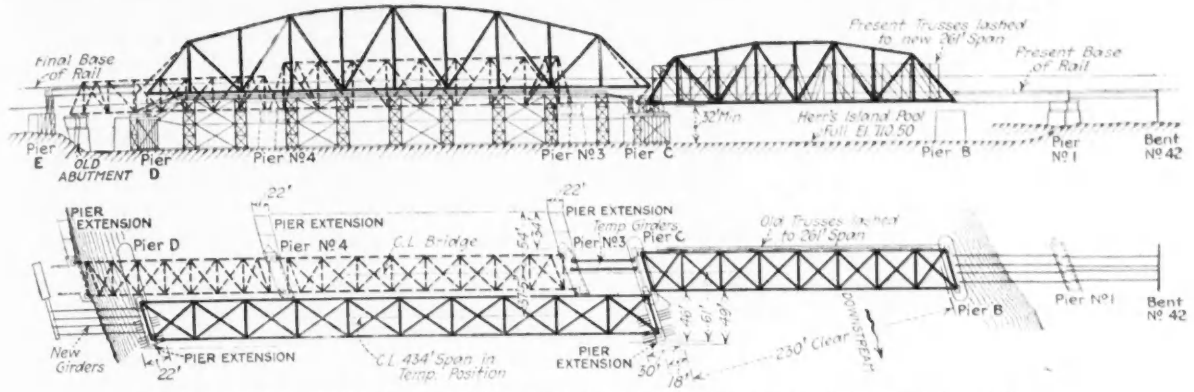


FIG. 2. RIVER SPANS OF 33RD STREET BRIDGE BEFORE TRANSFER OF CHANNEL SPAN

span *AB* at the east bank of the river was raised to the new grade prior to Dec. 20. This work was done by derrick cars, which lifted the pair of girders and set it on steel supporting bents. At the west bank, a similar girder span, erected on falsework with the channel span, had to be rolled with the latter.

Rolling the Channel Span

In rolling the large span, methods well established in a number of prior bridge renewal operations involving rolling were applied, and no difficulty or delay was experienced in the actual execution. These methods involve hauling the span on nests of closely spaced rollers placed under the shoes and themselves carried by a track formed by a rail grillage or by the flange plate of a girder, the hauling being done by tackle fixed between the span and the far end of the pier worked by hoisting engines usually carried on the moving span. To guide the movement and control it so as to hold the span in exact alignment, horizontal gage boards at the ends of the span marked off in feet and inches, are observed by a transitman, the foreman in charge of the rolling having telephone communication with the transitman and with the operators of the several hoisting engines. Practice has shown that a load on the rollers equal to the usual loading of expansion rollers is satisfactory and has given data on the amount of friction to be expected, so that the forces to be dealt with are known quite accurately.

In the present case a simplification was made as compared with some earlier undertakings of the kind, by allowing the new spans to push the old ones out of the way by means of blocking. As shown in Fig. 3, 3-in. rollers 8 ft. long were used, on 4-in. spacing, held by side bars made of flats bored to fit over the ends of the rollers. Taking account of the bearing length under the shoe bed plates, the roller load in the present case amounted to 1,960 lb. per lineal inch of roller, or about 650 lb. per lineal inch per inch of diameter. Rolling friction was assumed at 0.006 for 1-ft. diameter or the equivalent of 0.024 for the 3-in. rollers in the present case, although experience shows that this amount is possibly 20 per cent too high when the track is so supported that little local crushing occurs at the transfer between wood and steel or masonry supports.

The load to be moved included 5,500,000 lb. weight of the new channel span, 200,000 lb. weight of the girder span *DE*, and 1,880,000 lb. weight of the two old truss

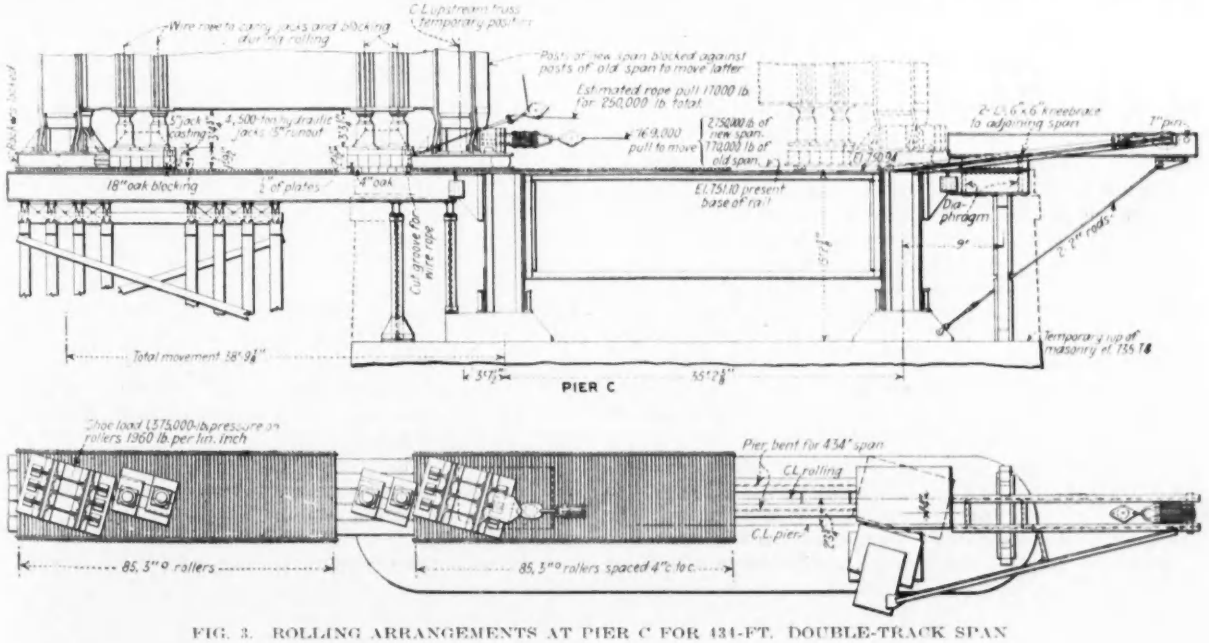

Wire rope to carry jacks and blocking during rolling
C.L. upstream truss temporary position
Posts of new span blocked against posts of old span to move latter
Estimated rope pull 17000 lb. for 250,000 lb. total
5" jack casting
4,500-ton hydraulic jacks, 5" runout
169,000 pull to move
250,000 lb. of new span, 170,000 lb. of old span
2-C.I. 6"x6" kneebrace to adjoining span
T" pin
El. 751.94
18" oak blocking
4" oak
El. 751.10 present base of rail
Diaphragm
2" rods
Total movement 38'9¼"
Temporary top of masonry el. 735.18
PIER C
Shoe load 1,375,000 lb. pressure on rollers 1960 lb. per lin. inch
Pier bent for 434' span
C.L. rolling
C.L. piers
85, 3" ø rollers
85, 3" ø rollers spaced 4" c. to c.

FIG. 3. ROLLING ARRANGEMENTS AT PIER C FOR 434-FT. DOUBLE-TRACK SPAN

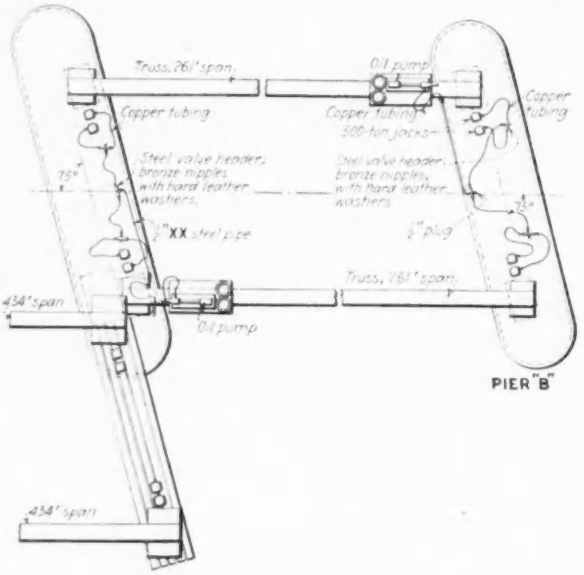


FIG. 4. PLAN OF JACKS AND PUMPS FOR RAISING 261-FT. SPAN TO NEW TRACK GRADE

spans; of the total, about 3,520,000 lb. was to be moved at pier C, 4,000,000 lb. at pier D, and something over 100,000 lb. at E. The rigging used, arranged as shown in Fig. 3, consisted of twenty-part tackles of ¾-in. steel rope at *C* and *D*, and an eight-part tackle of 1¼-in. manila rope at *E*. Connection of old and new spans was made by placing wooden blocking and struts between the posts of the two spans at a number of points; the pushing resistance of the old spans thus had to be resisted by the lateral bracing of both old and new spans.

Moving was accomplished in 14 min. actual moving time. The total distance of rolling was 38 ft. 9¾ in., the average movement nearly 3 ft. per minute.

The falsework supports on which the span was swung consisted of eight 8-pile longitudinal bents, each capped with a 12 x 12-in. timber and two 24-in. I-beams. At pier C these were pony bents resting on a lower story of similar construction, which had previously served as end support for the 261-ft. span. On the caps of the bents were placed five 30-in. girder beams as track for the rolling, extending over the end of the masonry pier and carried here by two short steel bents as indicated in Fig. 3; they were also spliced to the shoe-supporting bracket of the pier bent which formed the remainder of the track.

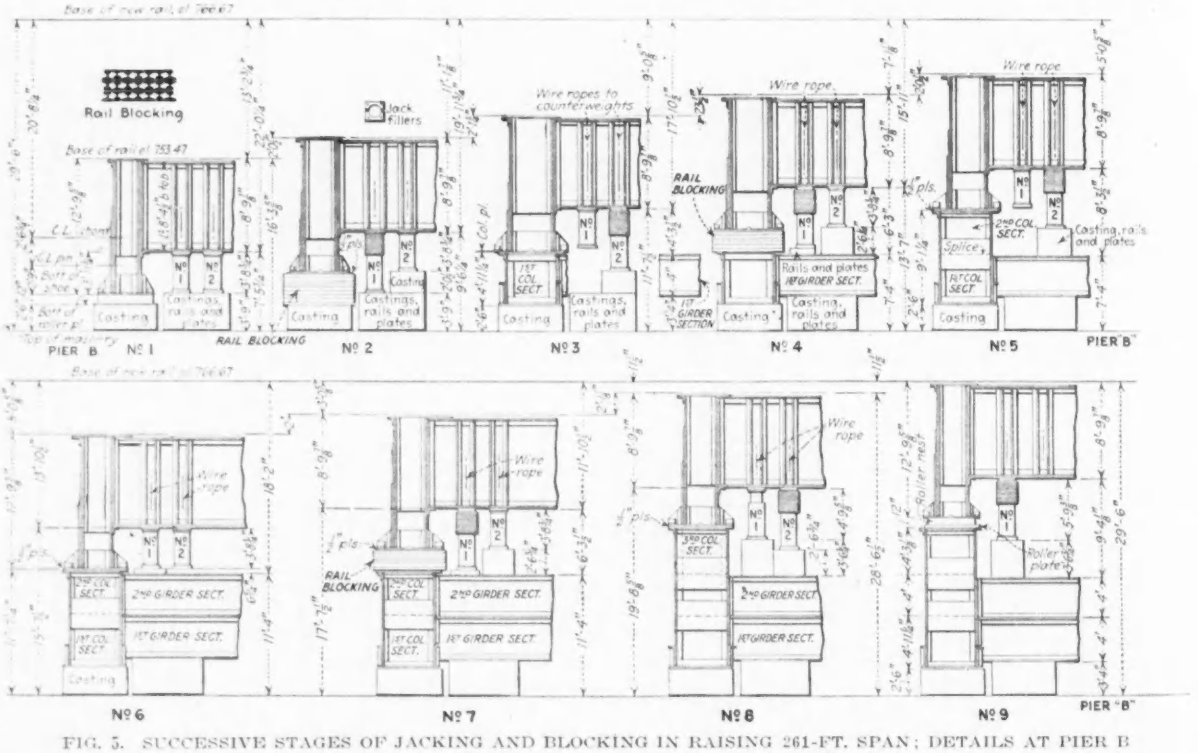


FIG. 5. SUCCESSIVE STAGES OF JACKING AND BLOCKING IN RAISING 261-FT. SPAN; DETAILS AT PIER B

Operation 1—Two 500-ton jacks supported on blocking, in place under end floor-beams. Both jacks counterweighted, using a spare jack as counterbalance. Jack 2 was held up against the floor beam by counterweight so as to be carried up with span. Jack 1 was pumped up and, as the span rose, annular filler plates were placed between the cap and barrel of the jack to take the load in case the hydraulic connections failed.

Operation 2—Blocking of rails, placed alternately head up and base up, was built under the shoe of the span and under Jack 2 as the span went up. A total lift of 2 ft. ½ in. was made. Roller nest and roller plate were removed, making the blocking under the shoe 3 ft. ½ in. high. The span was lowered to bearing, releasing Jack 1, the filler plates were removed from this jack and it was pulled up to the bottom flange of the floorbeam.

Operation 3—Jack 2 now lifted the span 2 ft. 1¼ in. The blocking under half the area of the shoe was removed and the first section of column pushed under, then the other half of the blocking removed and the column section set in final position. The span was lowered to bearing on the column, Jack 2 slacked off, the filler plates removed and the jack pulled up to the floorbeam. The first section of girder was set in place between the columns and bolted, blocking wedged in tight under the girder and blocking placed under Jack 1.

Operation 4—Jack 1 raised the span 1 ft. 11½ in., and blocking was built up under Jack 2 as it went up, also under the truss shoe. With 2 ft. 6½ in. blocking under Jack 2, Jack 1 was slacked off and pulled up.

Operation 5—Jack 2 now raised the span 2 ft. ½ in. The column cap was taken off, a second column section placed with the cap on it, and the span lowered to bearing on the column cap.

Operation 6—Jack 2 was pulled up and the second girder section set and bolted. Blocking was then placed under Jack 1.

Operation 7—Jack 1 raised the span 2 ft., the shoe and Jack 2 being blocked.

Operation 8—Jack 2 raised the span 2 ft. 1⅛ in., the column cap was removed and the third column section with cap set in place.

Operation 9—With 3 ft. 6¾ in. blocking under Jack 1 the span was raised 11½ in. to final grade.

In preparing for the rolling, the old spans were picked up by four hydraulic jacks at each end of each span, working against short lifting girders from which hung wire rope slings bent around the end pins of the spans. Then the rollers were inserted under the shoes and the spans lowered down on the rollers. The sections of roller nest between the shoes were then placed and linked up. In the case of the new span the rollers had been placed under the shoes before swinging the span, so that it was only necessary to complete the roller bed. After the move the roller sections between shoes of the new span were first disconnected and removed, and the span then raised by jacks placed under the end floorbeams, to remove the rollers under the shoes.

At pier D, where the pier bent moved with the span, knee-braced struts from the base of the bent to the lower chord of the span served to stiffen the connection and provide for longitudinal forces. At pier C the span rests on an expansion bearing as sketched in Fig. 3; these rockers of this bearing were blocked by locking plates until the move was completed and the rollers removed from under the shoes.

Raising 261-Ft. Span 15 Ft.

Immediately after completion of the rolling, the work of raising the 261-ft. span to the new track grade started. The amount of the lift was 13 ft. 2¾ in. at the east end (pier B) and 15 ft. 2¾ in. at the west end (pier C). The load to be lifted was about 1,200 tons, or 600 tons at each pier. Four hydraulic jacks of 500 tons capacity were used at each pier, in sets of two working and two idle, as indicated in diagrammatic plan in Fig. 4. These jacks had a run-out of 26 in. By lifting the idle pair of jacks with the span, setting blocking under it and then using these jacks for a further lift, a continuous lifting process was possible. However, to avoid having to carry up blocking more than moderate heights, the steel columns that were to support the span in its raised position were made in three superimposed sections, so arranged that they could be set in place successively as the span reached one-third, two-thirds and full height. Similarly, the girder diaphragms connecting the two columns on either pier were constructed as three superimposed sets of girders for successive placing. After setting in place any one story of the columns, it was necessary to lower the span to bearing on the columns, raise both jacks and remove the blocking under them, and insert the girder section between the columns. For the further operation the jacks footed on the girder as previously they had footed on the pier.

Sequence of Operations

Thus the lift at each end was accomplished in three successive raises of about 4 ft. each. A fourth lift was made at pier C for the purpose of inserting a cast pedestal intended to equalize the shoe heights of the two adjoining spans.

Fig. 5 sketches the sequence of operations, and gives the necessary explanations. It represents the work on pier C, that at the other end being slightly different in the final stage only. At each pier the two sides were jacked as a unit, by virtue of the arrangement of the piping shown in Fig. 4. For the first fleet of the jacks both ends were carried up together; after that the ends were jacked up separately, as the height of the blocking at this stage of the operation made this method desirable, due to its increased stability and freedom from vibration.

All preparations on the two piers having been made in advance, jacking started at 9 a.m. on Dec. 20, and went on continuously, the work being completed at 12 midnight.

No difficulties of any kind were encountered in the jacking, but the work of placing the girders between the pier columns proved slow because of the skew of the girders with respect to their end connections and the columns. Work after dark also proved exasperatingly slow.

Connecting up the new track required another hour after the span was finally landed and secured. The first train crossed the new bridge at 2:05 a.m., 19 hr. after traffic was interrupted.

For the American Bridge Co., Richard Khuen, Jr., general manager of erection, and James L. De Vou, division erecting manager, were in general charge of the work. N. H. Orr, assistant engineer, directed the field operations. S. T. Frantz was general foreman. For the Baltimore & Ohio R.R., H. A. Lane, chief engineer, was in general charge. The immediate supervision of the work was in the hands of P. G. Lang, Jr., assistant engineer of bridges, and A. C. Clarke, district engineer. The services of J. E. Greiner, consulting engineer, were also retained in connection with this bridge.

Seattle Additional Water Supply Plans To Go Forward

The projected addition to the water supply of the city of Seattle, Wash., to cost about $6,000,000 will soon be started. The following outline of the project has been supplied by A. H. Dimock, city engineer.

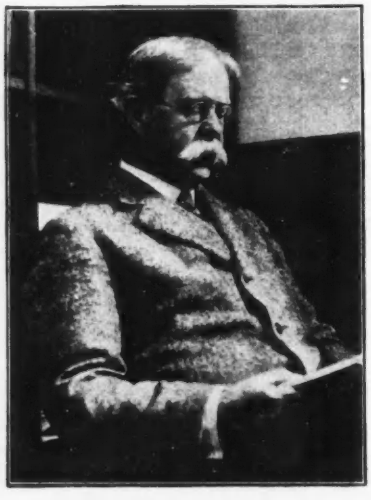
The new scheme utilizes Swan Lake, with an area of about 500 acres, 15 miles southeast of the city along the main supply conduit from Cedar River. The lake will be raised about 20 ft. by earth dams, the construction of which are now under way, giving an available storage capacity of about 4,500,000,000 gal. and will be tapped by a two-mile tunnel connecting with the Cedar River conduits and a new pipe line to the city reservoirs.

The new pipe line will be of steel, 66 in. in diameter and 16 miles long. The plans also provide for enlarging Volunteer Park reservoir in the city of Seattle by the addition of a second basin which will increase the storage capacity from 23,000,000 to 60,000,000 gal. The new pipe line will increase the water supply of the city to a total of 100,000,000 gal. daily, the combined capacity of the two existing pipe lines now serving the city being about 60,000,000 gal. per day, which is all needed at times of maximum draft. Contracts for enlarging the reservoir will be let immediately and will soon be followed by contracts for the steel pipe line.

Plans not yet authorized and not included in the $6,000,000 estimate contemplate the construction of a fourth pipe line which will increase the supply to 150,000,000 gal. daily, the construction of additional distributing reservoirs having a capacity of 250,000,000 gal., and a diversion conduit leading from Cedar River to Swan Lake and having a capacity to deliver 300 sec.-ft. of water.

William T. Sedgwick

Dr. William T. Sedgwick, senior professor and professor of biology and public health at the Massachusetts Institute of Technology, widely known as a sanitarian, epidemiologist and civic worker, whose death Jan. 26 was announced in this journal Feb. 3, was born at West Hartford, Conn., Dec. 29, 1855, and graduated from the Sheffield Scientific School, Yale University, with the degree of Ph.B. in biology, in 1877. In 1881 he took the degree of Ph.D. at Johns Hopkins University. Later Yale gave him the degree of D.Sc., and but recently he received from the University of Cincinnati the degree of LL.D. In 1883, having had experience in teaching both at Yale and Johns Hopkins, Dr. Sedgwick became assistant professor of biology at the Massachusetts Institute of Technology. There he remained until his death, becoming associate professor of biology in 1885, full professor in 1891, and director of the Sanitary Research Laboratory and Sewage Experiment Station in 1902.



PROF. W. T. SEDGWICK

From 1888 to 1896 Dr. Sedgwick was biologist of the Massachusetts State Board of Health. This was during the inception and early years of the studies of water and sewage purification at the Lawrence Experiment Station. In these and later years Dr. Sedgwick also established and maintained a high reputation as epidemiologist, particularly in connection with water-borne outbreaks of typhoid fever. He also created and carried on the course in sanitary biology at the Institute, which has trained hundreds of men in the fundamentals of public health work, including engineers, chemists and bacteriologists. Since the reorganization of state health administration in Massachusetts in 1914 Dr. Sedgwick had been a member of the Public Health Council. He was also a member of the Advisory Board of the Hygiene Laboratory of the U. S. Public Health Service since 1902, Assistant Surgeon-General, U. S. Public Health Reserve of late and at his death was a member of the International Health Board, Rockefeller Foundation, and chairman of the administrative board of the Harvard Technology School of Public Health. He was curator of the Lowell Institute from 1897 and trustee of Simmons College, Boston, from 1899 until he died. He had been president of many scientific and civic associations, including both the Boston and the Massachusetts Civil Service Reform Association, the Society of American Bacteriologists, the American Society of Naturalists, the New England Water Works Association, and the American Public Health Association.

Dr. Sedgwick will be remembered by many as a charming and effective speaker and writer. Besides his numerous addresses he was joint author of a "General Biology," 1886; assistant editor of the "Life and Letters of William Barton Rogers, Founder and First President of the Massachusetts Institute of Technology," 1896; author of "Sanitary Science and Public Health," 1902; and joint author of "The Human Mechanism and the Sanitation of Its Surroundings," 1906, and "A Short History of Science," 1917.

One of the crowning honors of Dr. Sedgwick's long, varied and useful career was his appointment in 1920 as first exchange professor from the Massachusetts Institute of Technology to the Universities of Cambridge and Leeds, England, where he delivered lectures last year.

A more extended outline of Dr. Sedgwick's career up to the time he became president of the New England Water Works Associations appeared in *Engineering News*, Jan. 11, 1906, p. 31.

From an appreciation of Dr. Sedgwick prepared for *The Tech*, by Prof. George C. Whipple, M.I.T., '89, the following extracts are taken:

In his early days Professor Sedgwick was a scientist, keen for research; in his middle life he was an educator in science and an administrator in public health; and in his later life he was scientist, educator, administrator, and counselor—but always, first and foremost, he was the friend of young men.

I count myself fortunate to have been one of these young men—one who knew him in the early days when the science of bacteriology was in its infancy and when a splendid vision of the applications of biology to problems of sanitary engineering and public health was dawning in his soul. I was fortunate in being present at a dinner attended by about seventy-five of Professor Sedgwick's former students in 1906, at which time a volume of scientific papers written by them in commemoration of the 25th anniversary of his doctorate was presented to him. Now, fifteen years later, his students are far more numerous and through them his influence has been felt not only throughout America but the world over. His mature judgment on fundamental problems of education and public health was always a source of strength to his colleagues and the enthusiasm of his early years never failed him.

I count myself fortunate to have been present at the dinner given in the Walker Memorial last Saturday [Jan. 22] in honor of one of his favorite pupils, Prof. C.-E. A. Winslow of Yale, on the eve of his departure for Europe. At this dinner Professor Sedgwick presided with even more than his usual grace and the pleasant hours were spent looking both backward and forward—he looking forward to Winslow's new work at Geneva with the League of Red Cross Societies, and Winslow looking back to the days spent with his chief in the Institute laboratories. It was a small gathering of old friends and of students who have come from the many nations now represented in our School of Public Health. This gathering, small though it was, was typical of his expanding life.

Professor Sedgwick's interests overflowed the bounds of sanitary science and many of the people of Boston know him best as Curator of the Lowell Institute, as trustee of Simmons College, as President of the Sharon Sanitorium, or the Civil Service Reform Association.

Professor Sedgwick was fundamentally a great teacher. Those of us who knew of his weak heart—he often said jokingly that it was better than an insurance policy—marvelled at his activities during the war when he took on extra work that the American cause might not suffer.

Both Motor Trucks and Industrial Railway Used on Road Job

Dual Haulage System With Moving Transfer Point Solves Construction Problem on 7-Mile Concrete Job Laid from One End

By H. Eltinge Breed
Consulting Engineer, New York City

EVERY reliable and competent contractor knows that no matter how carefully he bids he runs the frequent risk of getting a bad job. When Samuel R. Rosoff of the Rosoff Engineering Co., New York City, discovered that his was the only bid on the Castle Creek-Whitney Point road in Broome County, New York, he scented trouble. And he got it. The way he emerged from it and escaped failure may be of interest to other contractors.

The specifications for the road looked harmless enough, and a preliminary survey of it indicated no unusual difficulties. The contract was awarded Dec. 9, 1919. The road is 6.93 miles long, surfaced with a concrete pavement 16 ft. wide, of a 1:2:4 mix, and reinforced with 25 lb. of metal per 100 sq.ft. The section is 6 in. in depth at the side and 7 in. in the center. The main items of the contract were: 53,500 cu.yd. of earth excavation; 12,100 cu.yd. of reinforced-concrete pavement; and 19,380 bbl. of cement. The engineer's estimate for the work was $305,472.50; and the contractor's bid was $303,837.48.

A study of the profile of the road revealed one difficulty. The only source of supplies was at the foot of a hill. Most of the road had to be built up that hill, and atop it. Stone came from a local quarry located at Sta. 335 in the valley. Deliveries of cement, sand, coal and plant had to be made by freight. The railroad crossed the road at Sta. 339, also in the valley, and here the contractor installed a switch and siding. The crusher was installed at Sta. 336.

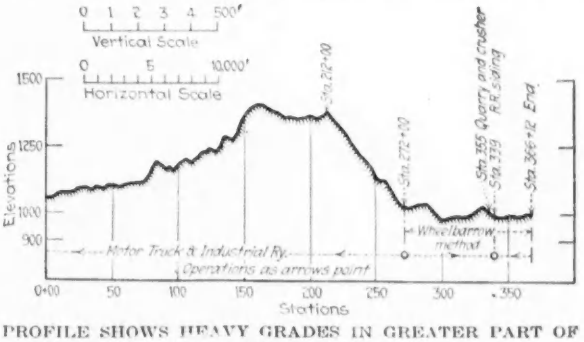
The problem was, how to proceed. The soil was a heavy clay that once excavated would be impassable after a rain. To go to the far end, start at 0 and work back toward the crusher would be impossible, because it would necessitate passing the steam shovel doing excavation. Moreover, extra cost would be involved because the heavy loads hauled over it would cut up and rut the subgrade.

The next method was abandoned because it involved losses of time that would have delayed the completion of the work until 1921. This method would have been to take a one-mile or a two-mile section and lay the pavement toward the source of supply, then wait the necessary fourteen days for the curing of the pavement to resume traffic over it and haul the materials to start the next section.

The other possibility was to start from the source of supplies and lay continuously to the far end. If this could be done, with no delays for bad weather, it was thought to be possible to complete the contract within the season.

The steam shovel would have to be started at the source of supply and work toward Sta. 0. Thus it could be kept far enough ahead to be out of the way of the concreting gang. The total yardage was 53,000, of which 42,000 was shovel excavation. This meant approximately 7,000 cu.yd. a month for a ¾-yd. traction shovel, or, allowing twenty days to the month, an average of 350 cu.yd. a day.

The obvious equipment for the work was industrial railway. But a complete equipment of this kind, with the other plant necessary for the work, would mean an outlay of over $100,000. This might have been justified had the nature of other work the contractor contemplated made it probable that he would have use for it in future. Such was not the case. For a single job of this size the expense was, of course, disproportionately great. Also, on this work there was an opposing maximum grade of 8 per cent in two stretches, one 1,325 ft. and the other 1,300 ft. long; and a 7 per cent climb on one part of the hill, the total of all grades being 443 ft. in elevation. In 5,600 ft. of distance with as stiff a grade as this the speed for



PROFILE SHOWS HEAVY GRADES IN GREATER PART OF SEVEN MILE CONTRACT

a train of four cars carrying eight batches of three-bag size for the 1:2:4 mix was estimated to be 2.4 miles per hour for about 7½ tons. On the 8 per cent grade with a six-ton gasoline locomotive this same train ran 2.6 miles per hour. Although the speed of operation could have been increased by using additional locomotives it seemed more economical to install only enough industrial railway equipment to allow the concrete to cure sufficiently so that it could be used for the hauling of materials over it in motor trucks. Therefore it was decided to use the railway and motor truck haul combined to do the work. The point of transfer was constantly to be shifted ahead as the pavement cured.

The main items of plant on the work were as follows:

One ¾-yd. traction steam shovel
One jaw crusher (200-ton capacity with 50-ton bins)
Four five-ton motor trucks
One one-ton motor truck
Seven thousand feet of 20-lb. industrial railway track.
One six-ton gasoline locomotive
Twenty-four cars
Forty-eight batch boxes
One concrete paver
One finisher
Steel forms, pipe line, etc.

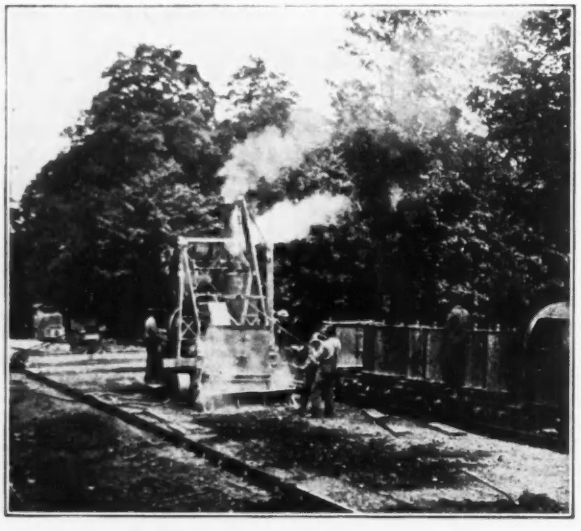
The total investment in plant was about $80,000.

In the actual construction, difficulties started immediately with transportation. No deliveries would be made on plant until June 1. To wait so long was fatal. So work started on May 10 at the end of the contract, Sta. 366. On May 18 the pavement was in up to the railroad track at Sta. 339. Aggregates were dumped on the sub-grade, and charged by the shovel and wheelbarrow method. The best day's work with a gang of 32 men was 450 ft. of pavement.

The cement gave out but by May 26 enough more was obtained to start again. The plant, of course, had not arrived, so by the former method concrete was laid from Sta. 272 back to Sta. 339. Thus, 1.75 miles of pavement was laid by June 21. Then came the inevitable wait for cement and industrial plant. By July 6 everything was in order, the plant set up at Sta. 272, and the work proceeded thence to the end of the contract.

A description of the locomotive and cars may be of interest.

The specifications for the locomotive called for one which would produce the drawbar pull of 2,400 lb.,



MIXER OPERATING ON 8 PER CENT GRADE
Note small mixing crew.

and would pull the following loads in cars that were required not to exceed 30 lb. per ton drawbar pull on a level:

Grades	Hauling Capacities Tons of 2,000 Lb.
Level	80
2 per cent	31
4 per cent	17
5 per cent	14
7 per cent	9
8 per cent	8

The weight of the locomotive was 6 tons. It had three speeds in either direction—low speed of about 3 miles an hour, intermediate speed of 6 miles per hour, and a high speed of 9 miles per hour. The transmission was of sliding gear selective type. All car frames were of steel provided with drawbar springs, and roller bearings. These weighed 1,007 lb. each and were fitted with 23-cu.ft. batch boxes weighing 480 lb. each, made of steel plates and stiffened at the corners by angle irons. The discharge was through the bottom, two doors being used which were held in place by a chain passing over the bearing on the top edge of the boxes and locking in position by means of a lever pin. The release of the pin opened the lever and dropped the doors. The doors were provided with projecting lips which overlapped when closed, making the boxes tight.

A train was composed of four trucks with eight batch boxes, this being the maximum load that the motor would take on the 8 per cent grade. The proportions of the different kinds of material were marked on the inside of the batch boxes and they were filled to their respective levels with sand and stone to which the cement was added. This transfer or reloading was done by hand. We estimated that hand loading was not quite as cheap as machine loading but we chose it because, among other considerations, it would insure continuity of operation with no losses due to equipment getting out of order.

One locomotive was used to transfer the loaded cars from the reloading station to the mixer. A second locomotive of lighter weight was used to spot the cars alongside of the mixer, and a turn-out was located between the mixer and the reloading station so that a passing point would be provided. The operation was to take a train of four cars up to the mixer and bring back four empties and take another loaded train up and bring back the empties in order that the mixer could be worked to full capacity. The small amount of equipment kept on this work made it necessary to have two loaded trains at the mixer for the start of work in the morning. Four cars were used till the summit of the hill was reached when the train load was increased to eight cars. The transfer point was advanced as the concrete gained sufficient strength to stand the motor-truck traffic.

The mixer had a rated capacity of 18 cu.ft. loose so it was necessary to keep it level as we were overloading it, using a three-bag batch, or about 21 cu.ft. of loose materials.

Personnel

The men operating this equipment consisted of a crusher gang which included: One fireman, two platform men, one loading, two drilling, one team, and six to seven men on loading stone. This outfit was able to keep the concrete gang laying in a nine-hour day from 335 to 420 lin. ft. of concrete, 16 ft. wide, and 6 in. thick at the sides and 7 in. thick at the center.

One ton of dynamite was used in quarrying 4,250 cu.yd. of crushed stone from a limestone quarry with a 30-ft. face operation in two levels. From two to five five-ton trucks were used to haul aggregate, depending on the length of haul.

The reloading gang was composed of six men shoveling sand, screenings and crushed stone, two men on cement, two boys with a foreman on cement sacks and greasing cars. Two engineers composed the train crew. One man took care of the pump which was amplified by a booster. He also took care of a second pump when it was necessary to run it.

The concrete gang consisted of one mixer engineer, two men spreading concrete, one man on mechanical finisher, one covering, two men on batch boxes, one foreman, two men setting forms, one man truing up grade. It took from six to eight minutes to load the eight batch boxes. The time to unload a train at the mixer was sixteen minutes.

The best day's work on the hill, using Sta. 272 as a reloading point, was 335 ft. of pavement. On July 20 and 21 about the same amount was laid, from Sta. 253 + 31 to 246 + 60. A glance at the profile will show the opposing grades upon which the trains were operated.

The advantage gained in utilizing motor trucks for the major part of the haul is that on grades such as these the motor truck can maintain a speed of from 5½ to 6 miles per hour as against the speed of approximately 2½ miles per hour with the industrial equipment. When the top of the hill is reached the train

length, train speed, and speed of mixer operation can be increased.

Considerable trouble was experienced in swinging the boxes around over the charging skip when the mixer was up hill because the mast was inclined down hill and would swing the batch boxes forward. In order to obviate this, wedge blocks were used under the front of the mixer to level it up so that the load would swing freely over the charging skip. To place these wedges the mixer was run a couple of feet back of its final position, and the wedges were placed on the plank; then the mixer advanced on the blocks. These had a cleat attached to the far end to keep the wheels from riding over the wedge, and a block was placed back of the wheel to hold it in position. These blocks also had another advantage in that they so leveled the mixer as to give full capacity on an 8 per cent grade.

The advantages to the contractor of the use of this equipment and method are obvious. The money work, that which costs least and shows the greatest margin of profit, is done first. That was, in this case, the short-haul concrete pavement, and its completion helped the contractor materially in his final work.

Wherever the pavement had been finished, haul over it by motor truck was much more rapid than it would have been by industrial railway.

In spite of the clay soil, concrete could be laid two hours after a rain.

Except a mile of track, two locomotives, batch boxes and running gear which all together cost $16,000, the major part of the plant may be easily salvaged or used in other lines of construction.

The completion of the work on time (the concrete pavement was finished Nov. 8), through the use and layout of this equipment meant an approximate saving of $20,000 which would have been lost had the work had to go over the winter.

Mr. Rosoff's own words throw light on the success of the work. He said, "The things that made that job go, that would make any job go, were the right equipment and layout; hustling from the word go, along every active foot of the road, from the contractor himself down to the last laborer—there shouldn't be five minutes of idleness on a job in man or machine; and then having someone from the outside to come in and help plan things and catch up the loose ends. Those factors saved the job, that bade fair to be the big loser in the state, and has turned out a winner."

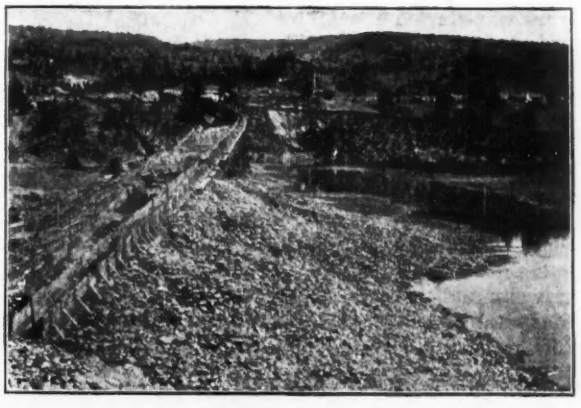
Arches and Girder Spans for Bridges

Several failures of newly constructed concrete arch highway bridges in New Jersey have been found due in part to improper design and in part to the inherent unsuitability of arch construction for the particular location in question. Bearing on this same point Charles A. Mead, bridge engineer of the State Highway Commission, said recently in a paper read before the New Jersey Association of County Engineers, "There seems to be a widespread notion that arches are beautiful. Some are. Being predicated on immovable abutments they should never be used in flat, marshy country where there is the slightest question of security concerning the founding material. Simple spans giving vertical reaction can be made attractive in appearance, and when they are in harmony with their surroundings and express a structural necessity they are pleasing."

Sheerboards Used in Building Hydraulic Fill Dam

Same Method Sloped Coarse Material or Placed Blanket of Fines — Lumber Cost, 1½ Cents Per Yard Sluiced

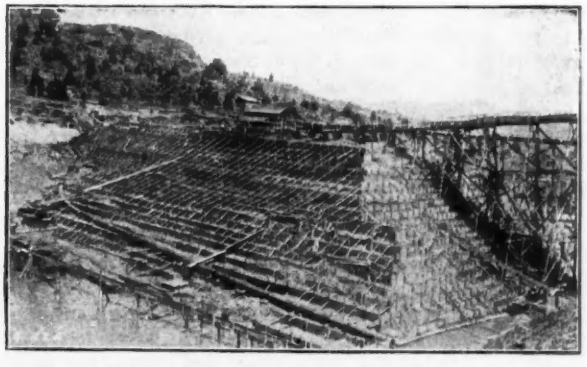
A METHOD of building high earth enbankments with sheerboards, which has previously been applied to regrading and terracing on a large scale (*Engineering Record*, May 4, 1912, p. 480 and Sept. 12, 1914, p. 288) was used in the construction of the dam recently built by the hydraulic sluicing method for the Ochoco Irrigation District near Prineville, Ore. The dam is 1,000 ft. long on top, 126 ft. high and contains 541,000 cu.yd. of fill. Three advantages claimed for the sheerboard



SHOWING SEPARATION OF COARSE AND FINE MATERIALS
(Compare gradual slope of fines in shallow center pool with coarse rock slope under flumes)

method, cited by the contractors as reasons for using it, are economy, accurate control of material and stability in the dam. In other words, the slight additional cost of lumber used for sheerboards made possible a large saving in labor; the method could be applied so as to segregate or consolidate material, as occasion required, and by this accurate control the proper class of material in core and embankments was secured, thus reducing the danger of sloughing or settlement.

The sheerboarding consisted of heavy stakes, set about 4 ft. apart, on the inside of which rough boards were nailed, beginning a few inches above the ground. As the fill progressed the sheerboards were set so the top of each lift was on the same level as the bottom of

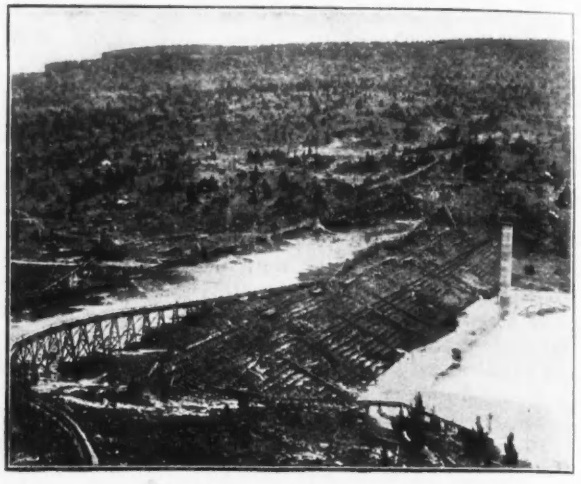


CHANNEL FOR THE STREAM MAINTAINED BY SHEERBOARDS

the horizontal spacing between lifts, the lifts having a standard height of 3 ft. Using this method, two men built up sheerboards as fast as required. Practically all the lumber was removed to be used over and over again. A simple stump puller, usually operated by a crew of three men, lifted out the stakes, after which most of the boards were easily removed by hand. The cost of sheerboard lumber for the entire job amounted to 1½ cents per cubic yard of fill.

The dam was built in three sections. In order to store water for the sluicing pumps, work was first concentrated on the upper toe dam, which was built to a height of 50 ft. Here the comparatively narrow core necessitated such careful segregation of material that temporary sheerboard bulkheads were occasionally used on the inside of both upstream and downstream prisms to keep the coarse material from the center core. When the work was started a small opening was left at the south end of the dam to take the flow of the creek. This channel was maintained as the fill progressed and was protected by carrying up a slope across the end of the fill by the sheerboard method. Thus for awhile the main fill had sheerboard slopes on two sides and one end.

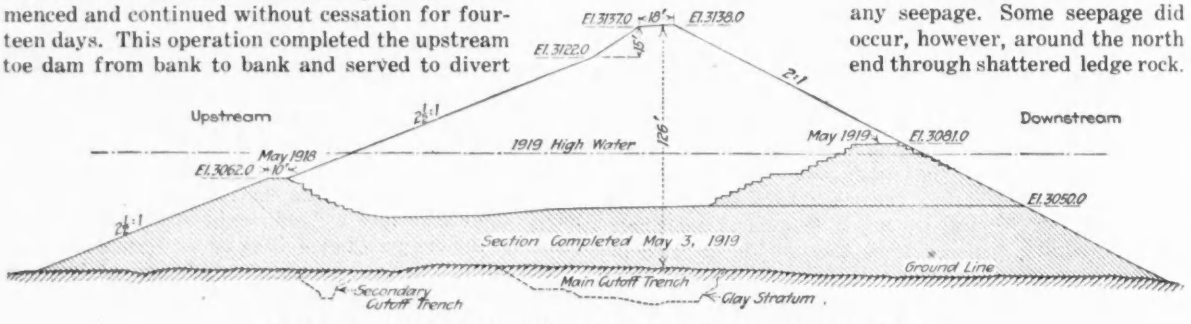
The method of affecting closure of the stream flow was as follows. When the toe dam had been completed to a height of 50 ft., except for the section near the south end where the stream channel was maintained, all fluming, timber bulkheads and other wooden structures as well as all loose rock were removed from the creek channel and banks. A timber gate for controlling the flow of the creek through the dam had previously been built and when preparations were completed this was closed and the creek waters were retained in the reservoir. Immediately thereafter the sluicing of material into the creek channel below the gate was commenced and continued without cessation for fourteen days. This operation completed the upstream toe dam from bank to bank and served to divert the waters of Ochoco Creek through the outlet conduit 35 ft. above the natural creek bed.



TYPICAL MATERIAL IN PLACE NEAR DOWNSTREAM SLOPE

taken from the spillway excavation. This was made impervious by sluicing over it a blanket of fines 6 to 8 ft. thick, placed as desired by the use of sheerboards.

In building up this downstream toe the sheerboards were used for consolidation or mixing rather than for segregation. No tight center core being required in this case the coarse material was not kept on the sides but was spread over the entire surface, and the fines, directed by sheerboards, were forced to flow over the coarse material filling the interstices and effectively consolidating the fill. The fill thus placed constituted a blanket on the down-stream toe dam and retained the water for several weeks without any seepage. Some seepage did occur, however, around the north end through shattered ledge rock.



CROSS-SECTION OF DAM, SHOWING PROGRESS OF FILL ON SLOPES

Upon completion of the upstream toe, work was commenced on the full width of the structure, depositing material on the downstream toe only, retaining the coarse material there and directing the fines into the center. When the fill had thus been brought to a height of 38 ft. it became desirable to begin storing water for the next season's irrigation. To do that effectively required a height of about 69 ft.

Accordingly work was concentrated on the downstream toe of the dam and this was carried on up independently as a separate structure 31 ft. above the remainder of the fill as it then stood. Water was impounded to a depth of 20 or 30 ft. over the major portion of the completed fill, as shown in the sketch, and to within 7 ft. of the top of the downstream toe dam. A part of this toe dam was made of large-sized rock When the reservoir level could be lowered work was resumed and the full cross section completed.

The summit pool on this dam was kept small and shallow; the average center depth of water varied from 2 to 4 ft., the range being controlled by the 20-in. sections of the central downspout which were added from time to time. The stable condition of material in the bottom of the pool is shown by the fact that on one occasion two men in a boat were able to force down a 1-in. rod only 11 ft. of which about 2 ft. was in water. Soundings from a boat indicated that as each additional length of downspout was added a new stratum formed. These strata appeared to dip toward the center.

The work on the Ochoco dam was done by the Puget Sound Bridge & Dredging Co., Seattle, through its sluicing department, formerly Lewis, Wiley & Morse, Inc. R. W. Rea was project engineer for the irrigation district and J. M. Howells was consulting engineer.

Traffic Policies for Vehicular Tunnels Endorsed

Transportation Committee Approves Two-Line 20-Ft. Roadways and Railroad Signal System

POLICIES of the New York-New Jersey Tunnel Commissions with regard to roadway width, traffic regulation and other matters connected with the vehicular tubes under the Hudson River were endorsed in a report by an advisory transportation committee, made public Feb, 7, as noted in the news columns of last week's issue. This committee, selected last year by C. M. Holland, chief engineer to the commissions, consisted of 12 representatives of motor vehicle manufacturers and other transportation interests. The committee recommends cement-grouted granite block with close joints for the tunnel roadways. The substance of its report, which consists chiefly of answers to seven specific questions, is given below:

Question 1—What should be the minimum width of a two-line roadway in order to take care of traffic needs, keeping in mind the great cost which is involved with each 6 in. of roadway width, and the fact that any such excess would necessitate a larger tunnel, which introduces additional difficulties in construction and increased first cost, consequently making a continuing increased operating charge? The present cost of the project is estimated to be approximately $30,000,000, which is 2½ times that which was originally fixed for the project.

The committee, having in mind the great cost and construction difficulty of each additional 6 in. of width of roadway, decided after observing the two lines of traffic on the Williamsburgh bridge for one hour, to recommend the adoption of Mr. Holland's plan for a 20-ft. roadway. The 20-ft. roadway will provide sufficient clearance between vehicles to allow rapid progress of two lines of traffic. Insufficient clearance between lines would slacken the speed, but this would occur only when two vehicles of maximum width were abreast. That condition rarely occurs. There will be no appreciable effect upon the speed of the lines because drivers operate in an enclosed structure with other vehicles near them, providing that each vehicle is required to remain in the line in which it starts. Strict rules should be made and enforced keeping slowly moving vehicles in one line.

The committee decided that it was not necessary to make practical road tests with several motor trucks loaded, running the trucks in two lines, because the observations from the Williamsburgh bridge gave a most practical demonstration of what could be expected.

Question 2—What will be the ultimate size of the automobile truck? Is it not true that this will undoubtedly be fixed by a legal limit and become standardized, similar to railroad equipment in America today? In other words, will not the limitations imposed upon rolling equipment, due to layout of city streets in the past, prove the ultimate limiting factor? This does not mean that there will not be wide avenues, but how about all of the secondary streets which serve as feeders to the main arteries of travel?

The ultimate size of the automobile truck—that is, its length, width and weight—will undoubtedly be fixed by legal limit and become standardized, similar to railroad equipment. Due to the layout of city streets in the past and the impossibility of widening all of them, it will be necessary to impose limitations upon rolling equipment. As a matter of fact this has already been done in many cities, limiting the width to 7 ft. Even if the width of vehicles allowed to use the tunnel was fixed by the States of New York and New Jersey at 8 ft., still a 20-ft. roadway should give 2 ft. operating clearance between and 1 ft. on each of the outer sides of the lines and the committee considers this clearance sufficient.

Question 3—At approximately capacity operation, should not all vehicles be compelled to keep in the line in which they start?

At capacity operation all vehicles should be compelled to keep in the line in which they start, except in case of stoppage by wreck or otherwise. If the stoppage can not be quickly moved, the police should allow vehicles in the stopped lines to alternate with vehicles in the moving line and thus pass on through the tunnel.

Question 4—What provision, if any, beyond a center line marker, should be made to keep vehicles in their respective lines? Should a crown be introduced, or should there be fixed boundaries such as grooveways or curbs?

Only a center line marker should be used to keep vehicles in their respective lines and the police should enforce this rule. A flat road surface should be provided, there should be no boundaries, such as grooveways or curbs. If grooves or curbs were provided serious delay would result in cases of stoppage of one line or during the time of day when the tunnel is being used to its maximum capacity. The lines would be retarded by slowly moving vehicles if prevented by grooves or curbs from passing the slowly moving vehicles.

Question 5—What is the recommendation of your committee in regard to the best method of taking care of disabled cars?

The best method of taking care of disabled cars would be by apparatus and removing disabled cars. Many heavily loaded vehicles will pass through the tunnel and some of them will break down; therefore strong, heavy wrecking wagons (motor driven) should be provided and equipped with jacks, blocking dollies, etc., so that if necessary the broken down vehicle could be towed out of the tunnel, thus clearing the line. No driver should be allowed to attempt to make a repair or adjustment or change any tire in the tunnel if the operation would take longer than one minute, except during the times when travel through the tunnel is less than 50 per cent of capacity.

Question 6—What suggestions have your committee in regard to the regulation of the movement of traffic, such as signal devices and police regulations?

The railroad system of signalling should be adopted. That is, when a stoppage occurs the nearest police officer should signal with a red light, if vehicles are required to come to full stop; yellow light if required to proceed slowly; green light to indicate lines clear. These signalling devices should be so arranged that one line could be control'ed independently of the other. Sufficient police force should be employed to enforce rules adopted and special attention should be given to vehicles entering the tunnel, so as to start slowly moving vehicles in one line and the faster ones in the other line to the greatest possible degree, even though many more vehicles might be started in one line than another.

Question 7—What suggestion has your committee as to the best method of cleaning the roadway of oils and gasoline drip, in order to have a safe roadway surface and eliminate the hazard of fire?

The best method of cleaning the roadway of oil and gasoline would be the application of a liberal quantity of torpedo sand, which should be swept away by mechanical sweepers at least once in each 24 hr. The committee is not in favor of having the roadway flushed with water as this would, on account of the grades, make the driveway hazardous when the roadway was wet; vehicles entering the tunnel from dry streets would not be prepared with chains to prevent skidding. Therefore, we believe dry cleaning is the proper method and suggest that it may be necessary occasionally to apply an alkaline powder which with the torpedo sand would scour the surface of the pavement. Bank sand should be provided at frequent intervals along the driveway on each side to be used when necessary to extinguish fire and soda-acid extinguishers of 10-quart capacity should be supplied and located in convenient places along each side of each driveway for further use in the extinguishing of fires. Also fire hose with suitable reel

and valves should be provided, the hose lengths to be sufficient to reach or lap one over the other and with sufficient capacity and water presssure to force a stream of water through a ½-in. nozzle at least 50 ft.

The signers of the foregoing report are:

E. E. LaSchum, (chairman) manager, motor vehicle department, American Railway Express Co.
P. V. V. Tobin, secretary, Howes Transfer & Contracting Co.
B. K. Rhoads, asst. supt. motor transport dept., American Railway Express Co.
I. A. Hungerford, manager, transport dept., Borden's Farm Products Co.
Frank B. Kurtz, manager, truck dept., Pierce Arrow Motor Car Co.
Frederick C. Horner, engineer, Packard Motor Car Co.
C. G. Pepoon, manager, transport dept., Tide Water Oil Co.
Charles S. Lyon, chief engineer, Packard Motor Car Co.
E. C. Walker, supt. of motor vehicles, William Farrell & Son Inc.
Henry S. C. Brooks, vice-president, Burns Bros. Coal Co.
M. J. McDermott, traffic manager, James Butler Inc.
W. H. Moore, manager, Garford Motor Truck Co.

Failure of Steel Truss Support Wrecks Concrete Dome

By Edward R. Bowen
Consulting Engineer, Los Angeles, Cal.

On DEC. 16 the steel truss supports of a concrete dome over the auditorium of the new First Christian Church at Fifth and Locust Sts., Long Beach, Cal., failed, allowing the dome to fall. The building was nearing completion. Forms had been removed from the dome for more than two months and the ceiling of the auditorium was plastered; the exterior art stonework was being set. The failure occurred at noon, just after the workmen had stopped for lunch, so that there were fortunately no fatalities and only a few minor injuries.

The concrete dome (Fig. 1), the top of which was 76 ft. above ground, was 48 ft. in diameter, springing from a vertical concrete wall 8 in. thick, resting on steel trusses. The dome structure comprised eight 12 x 12-in. ribs carrying a 3-in. shell, all reinforced with rods and steel fabric. Its total weight was 200 tons.

A square of four steel trusses, supported upon four reinforced-concrete columns, carried the dome. The steel framing is shown in Figs. 1 and 2. At the time of the failure the entire dead weight of the structure was not on the trusses, as the stone veneer on the top of the dome had not yet been placed, a weight of about 60 tons.

The concrete columns formed a square about 62 ft. on a side. The C trusses are rested on the columns and the D trusses framed into these. The diagonal E trusses framed into the C and D trusses near their midpoints. The foot-wall of the dome was carried by the E trusses and by 15-in. diagonal I-beams framing between them. The C and D trusses were strutted to the E trusses by 6-in. H-sections as shown on the diagram, Fig. 6; these struts extended from the top chords of the C and D trusses to the top chords of the E trusses. The top chords of the D trusses were tied into the east and west walls of the building by two 15-in. I-beams which carried small turrets. The plans showed these beams framing into the top chord but in the construction they were dropped about 2 ft. below the top chord and hung to a gusset plate, so that the only lateral stiffening was that of the ½-in. plate. The 20- and 24-in. I-beams carrying to the C trusses framed into a vertical member about 3 ft. above the bottom chord, so that the top chords of these trusses had no lateral support save that given by the E trusses and the 6-in. H-section.

Details of the trusses are shown in Fig. 2. The bottom chord of both the C and D trusses was given lateral stiffness by the ceiling joist resting on longitudinal angles about 2 ft. above the bottom chord.

Examination of the wreckage shows that the columns are in excellent condition, the only damage being a slight spalling off of the corners and inside face where the trusses scraped in falling. While the dome fell with the trusses, its concrete was excellent; no evidence of poor concrete was observed anywhere in the building.

Failure originated in the steel framing, probably in the east truss D, as this truss is at the bottom of the débris. The exterior walls on the east and west sides fell *outwards*, the wall on the north side fell *inwards*. The south wall was not extended above the 20-in. I-beams, but these beams were pulled in. The position of the trusses C and D after failure is shown in Fig. 6. In the writer's opinion the east D truss failed by buckling outwards in the top chord. This pulled on the two attached E trusses, which drew the

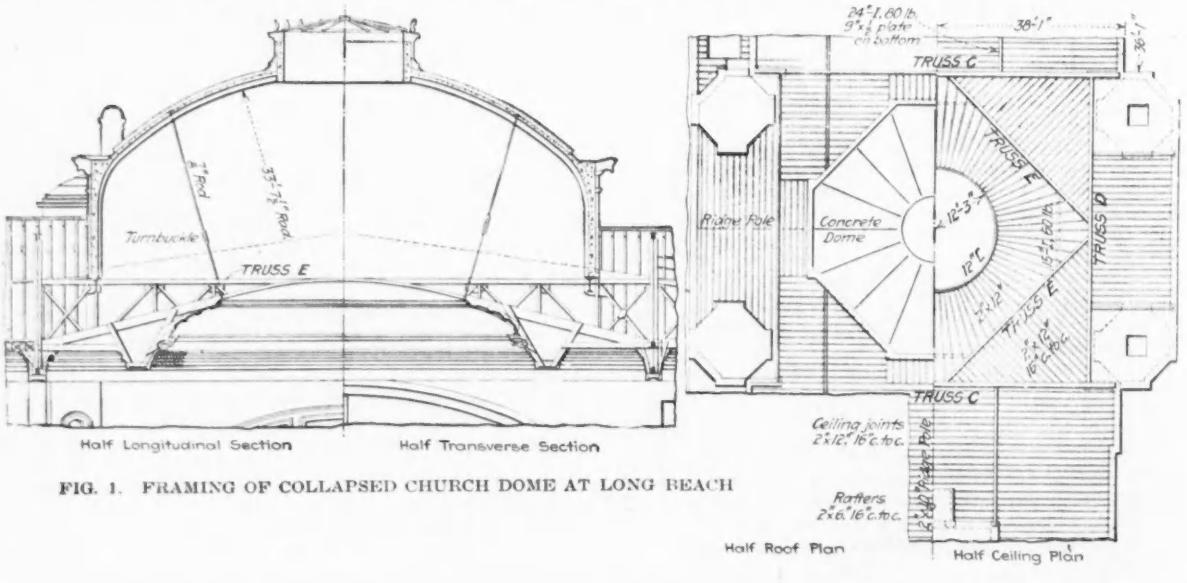


FIG. 1. FRAMING OF COLLAPSED CHURCH DOME AT LONG BEACH

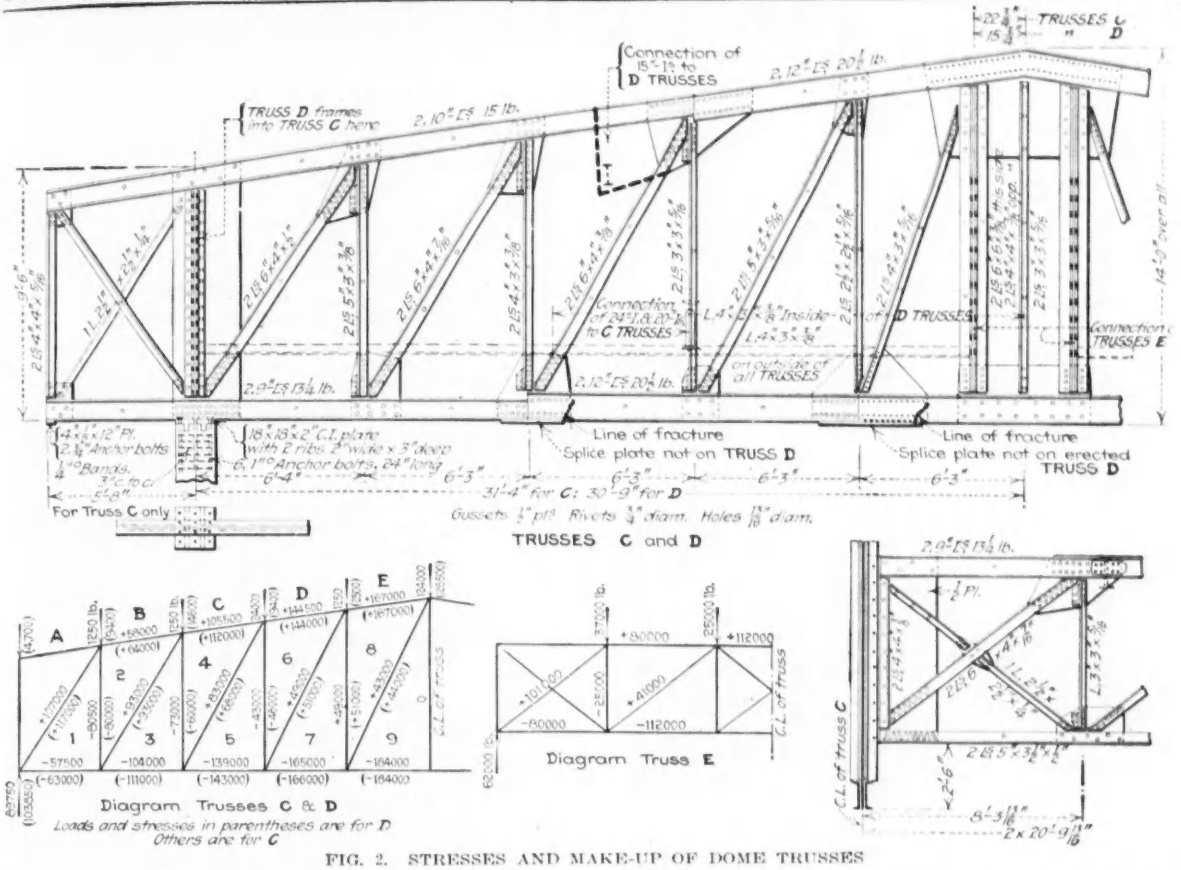

TRUSSES C & D
Line of fracture
Splice plate not on TRUSS D
Line of fracture
Splice plate not on erected TRUSS D
Diagram Trusses C & D
Loads and stresses in parentheses are for D
Others are for C
Diagram Truss E

FIG. 2. STRESSES AND MAKE-UP OF DOME TRUSSES

C trusses inwards and, so long as the columns were firmly held, pushed the west D truss outwards. The bottom chord of the east D truss shows a fracture at the point indicated in Fig. 2. The bottom splice plate shown there was not on the erected truss. Sections of the bottom chord at this point are being tested, but the appearance of the fracture did not indicate poor quality steel to the writer.

The débris is being cleared away as rapidly as possible, and the owners plan to complete the building at once.

The architect was Robert H. Orr of Los Angeles, and the contractor was J. D. Sherer of Long Beach. Prior to construction a report on the structural steel framing was rendered by E. L. Mayberry, a structural engineer of Los Angeles, at the solicitation of the contractor. Mr. Mayberry condemned the design upon the ground that no allowance had been made for wind loads, the dead load only having been considered, and that there was not sufficient lateral strutting. He approved the design of the reinforced-concrete columns and the I-beams carrying the roofs of the wings and the turrets.

Referring to the trusses, Mr. Mayberry presented the stress tables reproduced below, for trusses E and C, including the safe strengths of the members and the stresses given on the architect's design drawing (sheet 113, of which a part is reproduced in Fig. 2 herewith). He computed the live-load stresses for 30 lb. per horizontal square foot, the amount specified in the Los Angeles building ordinances, except in case of the dome and turrets, on which he assumed a 15-lb. live-load.

Concerning the stresses he says in this report:

You will observe from these tables that my dead loads check very closely to the recorded loadings on the stress diagram on Sheet 113. You will also see by the tables that in the majority of instances the stresses in the members of the trusses as recorded on the stress diagrams on Sheet 113 are in excess of what is considered to be the allowable safe stress which the members are good for.

STRESS TABLE FOR TRUSS E

Member	D. L. Stress	Combined	Member Good For	Recorded Sheet 11
A–1	104,000	110,500	91,000	101,000
B–2	82,000	87,000	120,000	80,000
C–4	110,500	125,500	116,500	112,000
1–0	82,000	87,000	114,000	80,000
3–0	116,500	125,500	114,000	112,000
5–0	116,500	125,500	114,000	.....
1–2	26,500	30,000	24,000	25,000
2–3	43,500	48,500	39,000	41,000
3–4	.....	.....	.....	.....
4–5	.....	.....	.....	.....

The first table is for truss E and the second for truss C. On account of the results obtained in connection with truss C, I did not think it necessary to further investigate truss D, in view of the fact that I would anticipate similar results in the case of truss D as those obtained for truss C.

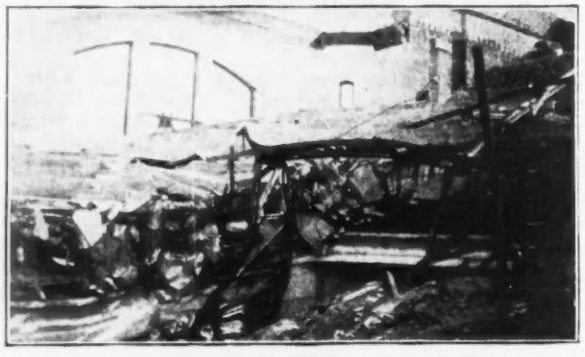
STRESS TABLE FOR TRUSS C

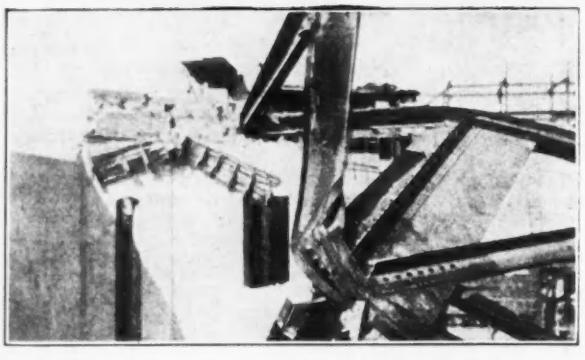
Member	D. L. Stress	Combined	Member Good For	Recorded Sheet 113
A–1	101,500	143,000	99,000	107,000
1–2	75,000	106,500	81,000	80,500
2–3	88,000	125,000	82,000	93,000
3–4	68,000	95,500	68,800	73,000
4–5	77,500	109,000	67,000	83,000
5–6	41,500	50,500	48,400	43,000
6–7	46,500	57,000	34,000	49,000
7–8	38,000	47,000	38,400	49,000
8–9	42,500	52,000	31,000	43,000
B–2	57,000	81,000	116,000	58,000
C–4	104,000	146,500	116,000	105,500
D–6	141,500	200,000	157,000	144,500
E–8	163,000	226,500	157,000	167,000
1–0	56,500	80,000	112,500	57,500
3–0	102,500	145,000	112,500	104,000
5–0	140,000	198,500	178,200	139,000
7–0	161,000	228,000	178,200	165,000
9–0	180,000	247,000	178,200	184,000

The results as given in the foregoing tables are based upon the assumption that the trusses are strutted properly in a lateral direction. There is at present an entire absence of such struts.

This report was rendered Dec. 17, 1919. In a supplementary report some days later Mr. Mayberry credited the web diagonals with somewhat higher strength on account of restraint of their ends by the heavy chords, as the result of a discussion of the stress sheet with the engineer for the steelwork, H. A. Larsen. He therefore stated:

Allowing a little more liberal construction of the problem, we find in the case of truss C the two members A-1 and 2-3, instead of being overstressed as shown by the table, to be good for a stress equal to the recorded stress on Sheet 113. The other three web struts, 4-5, 6-7 and 8-9, would be overstressed 10 per cent, 28 per cent and 7 per cent respectively, considering the recorded stresses, which





FIGS. 3 TO 5. VIEWS OF DOME WRECKAGE
Upper—South C Truss and West D Truss.
Middle—East D Truss and South C Truss.
Lower—East End of North C Truss; Part of Bed Plate.

Mr. Larsen has informed us are for dead-load conditions only. In regard to the top chord of the truss, there is only one way in which to consider the length of struts, and that is from center of panel point to center of panel point. This, however, does not change the condition that the truss is

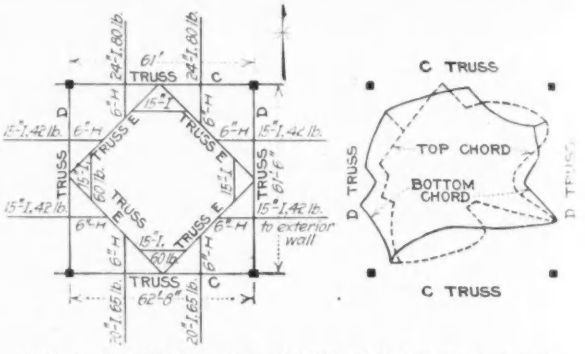


FIG. 6. POSITION OF TRUSSES BEFORE AND AFTER COLLAPSE

not calculated to carry any live load whatsoever, and it is my opinion that under existing conditions, with the high wind velocities that exist at Long Beach, it is absolutely necessary to take into consideration a live-load stress.

As stated before, my calculations are based entirely upon the top chords of these trusses being properly strutted.

These trusses will probably stand up under a dead-load condition only without consideration of wind pressure or possible superimposed live load. However, this is not in accordance with good design, and I am still of the opinion that the trusses should not only be strutted, but strengthened.

In fuller explanation of his attitude on the bracing of the trusses Mr. Mayberry advises *Engineering News-Record* that he "did not investigate the top chords in their unstrutted condition, as it never occurred to me for a moment that anyone would authorize the construction of these trusses in the face of my report."

Subsequently another engineer was engaged by the owners to report on the steelwork. The design was approved by him, and thereupon the contractor was instructed to proceed.

Australian Steam-Electric Plant to Use 50-Cent Coal

Construction is to be started April 1 on a 125,000,000 kw. steam-electric plant, 112 mi. from Melbourne, Australia, according to announcement from Australian government offices. This is a governmental undertaking, to be carried out by the Victoria Electricity Commission, which proposes to develop extensive coal deposits at the plant site, use the coal for generating electrical energy and transmit the power electrically to Melbourne and other industrial centers. Included in the project for which immediate construction is planned are a total of 1,800 mi. of high tension transmission line and three terminal substations. The trunk line voltage will be 132,000.

The coal deposits are said to be very extensive, enough being available within a half-mile radius of the power house to operate the new plant for 150 years. The coal is found in a seam 273 ft. thick under a 33-ft. overburden and can be delivered to the power house for about 50 cents per ton the report states. Condensing water is supplied by a river alongside the power house. A single building is to be provided for engine room and boiler plant, while control apparatus and offices will be housed in a second structure. Transmission will be over a two-circuit steel tower line with towers spaced 1,000 to 1,500 ft. apart, these long spans being deemed most economical for the high tension insulators to be used.

Some Recent Developments in Wood Preservation

Abstracts of Papers and Committee Reports Presented at the San Francisco Convention of the American Wood Preservers Association, Jan. 25, 26 and 27.

Conclusions of Experiments With Cresoil

By R. G. Smith

CRESOIL is a solution of 95 per cent mineral oil, preferably of an asphaltic base, and 5 per cent of cresol or cresylic acid. Results of tests made on Douglas fir at the St. Helens creosoting plants are as follows:

The solution is stable, i.e., there is no separation or filtering action of the wood on cresoil. It can be injected into wood satisfactorily and more easily than creosote. One test indicated a greater toxicity than creosote and another test less toxicity, but sufficient. The loss due to evaporation is less than one-half the amount of creosote. After ties had been evaporated to a constant weight, three times as much of both creosote and cresoil was left as necessary to kill all fungi. Service tests on ties placed in 1915 on two different railroads indicate a wide margin of safety in toxic value in amount left, 2.23 per cent and 2.43 per cent respectively.

Creosote Treatment for Douglas Fir Pipe Staves

By H. E. Horrocks

IN THE PROPER treatment of wood for stave pipe, the principal ends to be obtained are as follows: Adequate protection of the wood from decay; freedom of the stave from shrinking or distortion from its section and contour when machined; minimum of contamination of water flowing through the pipe; wood must retain its original strength and elasticity; no deposit left on the stave after treatment.

For both machine-banded and continuous stave pipe, the staves must be treated before assembling. Attempts were made to treat small sizes of completed machine-banded pipe, but the heat and handling invariably loosened the wires, making the pipe useless.

The stave stock must be thoroughly air or kiln dried in the rough, then machined to its finished shape before treatment. Being well dried, it is ready to receive creosote with pre-seasoning in the retorts. This insures against loss of strength or elasticity, against shrinkage, and, with careful stowing on retort trams, against distortion.

For adequate protection against decay it is not necessary that the creosote penetration be deep, since no further machining, framing or cuts for fastenings that might open up untreated wood are necessary. Through and through penetration would be highly undesirable, since the untreated but thoroughly dry wood in the interior of the stave very readily absorbs moisture, rapidly expands and insures a tight conduit. A ¼-in. penetration from all surfaces is considered satisfactory treatment.

An accumulation of pitch or sediment on the surfaces or edges of the staves would contribute to contamination of the water. It would also seriously interfere with close and accurate laying up of the pipe, increase the diameter of the pipe, and cause unequal bearing between staves, making watertightness difficult to accomplish.

If much free oil apppears on the surface of the staves, even though entirely liquid, water flowing through the pipe will very likely be contaminated for some time. To overcome these objections a straight distillate creosote is used for stave treatment.

The empty-cell process is used with 50 lb. initial air pressure, following the creosote pressure period with several minutes re-heating at about 25 deg. F. in excess of any previous temperatures, then a vacuum of not less than 20 in. maintained for from 30 min. to 1 hour. By this process a satisfactory creosote penetration is obtained and the staves come out thoroughly clean and so dry as to scarcely soil one's hand.

Treated Lumber for Insulating Roofs of Moist Factories

By F. J. Hoxie

A NEW USE for treated boards and planks is developing: heat insulation of roofs of cotton-weaving mills and paper mills. The object is to stop the rot which is rapidly progressing in them, by keeping the temperature above the dew point of the air in the room below. Two such roofs were installed two years ago in New England and are giving good results, not only in stopping rot, but in preventing sweating which has been troublesome in cold weather.

At present a Rhode Island weaving-mill roof is being covered with treated ⅞-in. North Carolina pine. This will require 130,000 ft. of lumber, which is being treated in an open tank in the mill yard. An absorption averaging 6 lb. per cu.ft. is obtained, although some of the light boards take up 12 lb.

When the treated boards were put on the roof the slag of the old roof was scraped off one bay with chisels. This involved considerable expense, and somewhat damaged the tarred paper, therefore, on the remainder of the roof the slag was simply swept off with stiff brooms.

The 2 x ⅞-in. sleepers were then nailed on, leaving a ⅞-in. air space under the insulating boards, the old slag roof remaining below the insulating covering to prevent the moisture from coming up into the air space from the highly humidified air in the room below. The present 2½-in. spruce-plank roof was installed 14 years ago, and has commenced to show unmistakable signs of rotting, although it still has sufficient strength to support itself and the new insulating covering.

Replacing the rotted planks of such a roof is by no means an infallible remedy, if the insulation or heating is not changed to keep the temperature below the dew point. Parts of two bays only two years old are now the worst rotted planks in the entire roof, due doubtless to the lumber containing considerable sapwood and having been kilndried. Therefore, when subjected to the highly humidified air of the weaving mill the lumber swelled and made a tight surface and kept the liquid water in, which had passed into the wood as a vapor and condensed in the cooler interior.

This form of insulation will considerably increase the

life of a new roof, or a new roof can be made of heavy plank thoroughly creosoted and sheathed underneath having a thin air space, the sheathing serving as a painting surface and to prevent dripping.

Effect of Zinc Chloride Treatment on Strength of Wood

By Committee on Preservatives, Alfred L. Kammerer, chairman

CONCLUSIONS drawn from three papers on the effect of zinc chloride treatment on the strength of wood by Prof. W. K. Hatt, by H. B. Luther and by T. R. C. Wilson and Ernest Batemen are as follows:

The treatment of wood with the usual strength of zinc chloride solution seems to have but little permanent effect upon the strength of wood in bending even five years after treatment, provided the temperature of the wood during that time is not excessively high. There seems to be a slight permanent decrease in the resistance of zinc-treated wood to shock even at the normal temperature. This decrease seems to be greater with greater absorptions of zinc chloride. At temperatures somewhat higher than the normal there may be a considerable reduction in all strength values.

Douglas Fir Paving Blocks

By Specification Committee on Wood Block Pavement, J. E. Horrock, chairman.

SOUND wood of at least six annual rings per inch is required; sapwood is not a defect. Depths of blocks are specified as 4 in. for very heavy traffic, 3½ in. for moderate traffic and 3 in. for light traffic; the preferable length is twice the depth and the width should be 3 to 4 in. Variations of $\frac{1}{16}$ in. in depth and $\frac{1}{8}$ in. in width are permissible. The preservatives are coal-tar oil or distillate oil having the following requirements.

	Coal-Tar Oil	Distillate
Max. water content	3%	3%
Max. insoluble in benzol	3%	0.5%
Sp.gr. of oil at 38° *	1.07–1.12	1.03
Max. distillate up to 210° C *	5%	5%
Max. distillate up to 235° C *	25%	15%
Sp.gr. at 38° of distillate from 235° to 315° C	1.03	1.15
Sp.gr. at 38° of distillate from 315° to 355° C	1.10	1.10
Max. coke residue	10%	2%

* Compared with water at 15°C.

Air-seasoned or green timber is permissible but must be treated separately as follows: The charge shall be boiled in creosote at not to exceed 190 deg. F., under vacuum of at least 20 in. for 2 hours and not to exceed 6 hours, depending upon the degree of dryness of the timber. Pressure shall then be applied not exceeding a maximum of 125 lb. until the preservative has been absorbed in an amount about 3 lb. per cu.ft. in excess of the specified quantity. The temperature of the creosote shall then be raised to and held at 225 deg. F. for 1 hour, then exhausted from the retort, the steam shut off from the coils and a quick vacuum of 20 to 25 in. applied for a period of 30 min. to 1 hour.

In any charge, the blocks shall contain at least 12 lb. of water-free oil per cubic foot of wood at the completion of the treatment. The blocks after treatment shall show the preservative well diffused throughout the wood, and the sapwood shall be entirely and well treated. To determine this at least 25 blocks shall be selected from various parts of each charge, and if more than one of the blocks show untreated sapwood, the charge shall be again treated. After re-treating, the charge shall be again subjected to a similar inspection. The surface of the blocks, after treatment, shall be free from heavy pitch or tar-like deposits, and all blocks that have been materially warped, checked or otherwise injured in the process shall be rejected.

The blocks shall preferably be laid in the street as soon as possible after being treated. If they cannot be laid immediately, provision shall be made to prevent them from drying out by stacking in close piles and covering them, and, if possible, by sprinkling them thoroughly at intervals. In any case, where they are not laid as soon as they are received on the street they shall be well sprinkled about two days before being laid under the direction of the purchaser. It is important to have the wood sufficiently wet to be swelled to its maximum size before it is laid.

Conditions Under Which Non-Pressure Treatments Are Justified

By Committee on Economics, Carl G. Crawford, chairman

SINCE 46 per cent of all wood used in this country is used on the farms pressure treatment is available for but a fraction of 1 per cent of it. Great quantities are also used in other construction where pressure treatment is unobtainable, therefore non-pressure treatment is the only alternative. None of the commercial plants have any provision for small quantity distribution. As the annual decay of non-treated wood is estimated to exceed the loss of standing timber by forest fires, insect damage and disease an intensive educational campaign is recommended. Specific cases in which the engineer is interested where non-pressure treatments are likely to be advisable are as follows:

(1) For treating timbers and lumber used in building and car construction and repair work which must be framed at the building site, or which are used in such small quantities that it is impracticable to send them away for pressure treatment. Of the various non-pressure treatments possible hot and cold bath treatment with creosote will generally be most effective. When apparatus for this process is not available surface treatments may be used. For places where the odor or color of creosote would be objectionable water-soluble preservatives applied by the steeping process may be desirable. These preservatives are not suitable where the wood is likely to be wet frequently.

(2) For timbers used in interior construction where the ends are placed on concrete, brick or stone foundations, and only the ends are subject to decay, and for any other timbers where only points of contact with wood or other material are likely to decay prematurely. Surface treatments are usually the only methods which can be used in such places, but great benefit at little expense can be expected.

Perforating Poles To Obtain Better Non-Pressure Treatment

By Committee on Non-Pressure Treatments, L. L. Hill, chairman.

SINCE June 1, 1920, a commercial plant at Sand Idaho, has accelerated the non-pressure treatment of poles by the use of a perforating machine. The perforating is accomplished by chisel-pointed punches in the ends of heavy iron bars. These bars are raised by cams and allowed to fall, driving the punches into the wood by the weight of the bars. The distance through which the punches fall is regulated by an adjustable carriage upon which the pole rests, but is usually 2 to 3 in.

The bars operate independently but are released at the same time. This perforates a line of holes lengthwise of the pole. The pole is then automatically turned partway around and another line of holes perforated. In this way the entire surface of the pole for a distance of 1½ ft. above and below the ground line is perforated. The holes are so spaced that the oil is required to travel a distance of 2½ in. vertically, and not more than ¼ in. circumferentially, in order to obtain complete penetration.

The machine is not yet mechanically perfect and the operators plan to improve its construction. It is stated, however, that as now operated the machine permits of practically complete penetration of oil to the depth of the perforations. It is also stated that in some cases this penetration is not secured during treatment, but the continued movement of the oil in the wood after treatment is said ultimately to treat all the wood between the holes.

While the committee is greatly impressed with the possibilities of the perforating process definite conclusions cannot be drawn.

Financing Small Municipal Water Supplies in Illinois

Abstract of report of Committee on Water Supply presented to Illinois Society of Engineers by W. D. P. Warren, Decatur, Ill., chairman.

TWELVE cities in Illinois with populations of more than 2,000 people and 600 cities and villages with a smaller number have no water supply. Few new supplies have been installed in recent years and extensions to meet increasing demands in many cases have been inadequate. The past year was dry and conditions were especially bad in many cities that depend on surface or shallow ground water supplies. With the high cost of materials and insufficient bonding capacity to meet the expense of proper improvements, the situation has developed to a point where dangerous sanitary conditions will be created and industrial growth greatly retarded unless immediate relief is provided. A few cities have realized the situation and have remedied it, generally through the financial aid of citizens.

At Jacksonville, a citizens' committee organized a company to finance and purchase 380 acres of land essential to the development. A lease and option to and with the City Council for twenty years was then effected.

At Hillsboro, an $80,000 improvement was made with only $8,000 available from a bond issue. A part of the cost of the 14-in. cast-iron supply main, and the 300 acres of land necessary for the impounding reservoir, was financed by optional contract. Citizens executed notes running five years, for $100 and $200 each, to a trustee, who held title to a part of the land purchased, and who gave his notes as trustee to banks, putting up the citizens' notes as collateral. The city pays interest and at least $1,000 annually on principal.

Decatur, a much larger city, is now constructing a water impounding project which will cost $2,000,000, at least $1,000,000 of which will be raised by other than bond issue. A water-supply company financed by citizens was incorporated to acquire lands to be flooded and to furnish money to alter roads, raise bridges, etc. With this company the city enters into a contract in the nature of a joint undertaking to furnish water to the city. The city builds the dam, furnishes the existing pumping plant, water mains and intake. From a joint account into which revenues are deposited the city is to receive operating expenses exclusive of dam maintenence, depreciation betterments and further capital expenditures. The remainder of the joint fund is to be divided equally betwteen city and company. Cancellation of the contract by the company is provided in case a sum sufficient to pay a fixed return to the stockholders is not received. An option permits the payment to the company of a certain fixed sum and "payment in advance for successive periods of thirty days each of 8c. a 1,000 gal. for all water pumped during the preceding month." In case of default of contract by the city, the city is required to drain the reservoir. The company was organized with a nominal amount of no-par value stock and $1,000,000 of retirable par value stock. When the latter has been retired the few stockholders of the no-par value stock can cause the water company to convey its entire property to the city and wind up the corporation.

From Ralph J. Monroe, corporation counsel for Decatur, the committee obtained outlines for several possible ways of financing new water supplies and extensions. (1) New construction or purchase can be financed by the issuance of water certificates bearing interest and secured by mortgage and payable out of the income of the property and from no other source. A difficulty arises in applying this scheme to finance improvements since it is always a legal impossibility to devise any proper division of income which can be allotted part to the old plant and part to the new. (2) All other schemes depend on private capital, some of the common forms of which are (a) organization of a water-supply company to construct and operate the plant; (b) trustees to sell trustees' certificates, purchase the property and lease it to the city, (c) contract with a construction company to build the plant and later sell to the city on a conditional sales contract. Plan (a), the one in use at Decatur, is desirable where it can be used. It has an advantage over the municipal water certificate plan in that the corporation will hold title to the property until paid for and no foreclosure is required. The trustee arrangement, the one commonly used, is satisfactory, except that if the investment is sufficiently large, the amount payable in any one year might be a violation of the debt limit, but this can be avoided by having quarterly installments payable in advance.

The plan of letting a construction company build the plant has its advantages in that such an agreement relieves the city administration and local citizens from the worry and work in financing, but it will be found upon examination that this relief from worry and work is dearly paid for, as any contractor knows that his security is not of the best. He has to be well paid for the risk, local committees being much more restive if the security is all held by the contractor who knows that it is a long-time investment and figures on discounting the contract through some brokerage or banking firm. The discount is always very heavy; but as a last resort perhaps this plan is better than none.

Panama Canal Dredging Operations for Slides

Dredging operations were resumed at Cucaracha Slide on Nov. 15, 1920, owing to another general movement over this area, which occurred on the night of the previous day. Since that time, according to the *Panama Canal Record* of Jan. 5, one dipper dredge has worked continuously on a double-shift basis, removing from this slide 59,600 cu.yd. of material. Another general movement started on the last day of the month, but all material coming into the Canal at this point has been confined to the basin and has not interfered in any way with canal traffic. Including the excavation for November, the dredges have removed a total of 2,127,600 cu.yd. of earth and rock from this area since the slide of Feb. 22, 1920. Both Culebra and Barge Repair slides showed some slight surface movement during the month. At the Pacific entrance of the canal, 75,000 cu.yd. of earth, classified as maintenance work, was removed from the west side and center line of the Canal. In the Chagres River 25,200 cu.yd. of mud was removed in uncovering new gravel beds, and deepening the channel to the beds. At the Atlantic terminal a total of 75,400 cu.yd. of material was removed and dumped between the East Breakwater and Margarita Point.

Snow Surveying for the Forecasting of Stream Flow

Methods, Factors and Results in Making Spring Predictions of Summer Water Supply for Irrigation and Power in Streams Fed by Mountain Snows

By J. E. Church, Jr.
Nevada Co-operative Snow Surveys, Reno, Nev.

Part II—Predicting Run-Off from Large Areas—Inaugurating a Snow Survey System—Cost of Surveys

Wide-Area Forecasting—Uniformity of the snow cover in adjoining basins is an important feature in making practicable the forecasting of run-off from large areas. This condition of uniformity is due to the fact that winter storms which build the snow cover on the mountains are usually widespread in their sweep and that the gradient of their intensity is low and uniform for relatively wide distances. This is particularly true of the "big storms" that often furnish the bulk of the winter precipitation. However, in seasons of heaviest snow cover, the oscillation (as shown in Table IX) appears at times, but not uniformly, to be more accentuated than in seasons of normal or light snow cover.

The similarity of snow cover in adjoining basins is indicated distinctly by the snow surveys of 1917-20, the last two covering a distance of 95 miles, as shown by Table X. The gradient increases toward the south in 1917-18 and 1919-20, but toward the north in the intervening year. This uniformity is not a local peculiarity, but has been found also in the Wasatch range, Utah. For example, the snow surveys of 1913-16 in the City Cañon and Big Cottonwood Cañon creeks, conducted by the U. S. Weather Bureau and the engineering department of Salt Lake City respectively, varied from each other during the entire period only 1.7 to 2.9 in seasonal per cent, but the distance between these basins is only 14 miles.

Conditions for the Sierra Nevada Range—An important point is the probable uniformity and maximum variation in the snow cover of the entire Sierra Nevada range, as shown by the run-off of the streams. Owing to the relatively limited area of the snow surveys so far established, a broad view of the interrelations of the snow fields of the entire range must be obtained provisionally by using the run-off of the streams as the basis of comparison. To reduce the streams to a common standard, the seasonal percentage of each in terms of its own normal has been taken. Furthermore, to avoid all possible influences except that of the snow, the normals and seasonal percentages have been confined to April-July. The streams have been grouped laterally and transversely along the range to determine the probable amount of oscillation in the snow and the detailed snow surveys necessary to detect it.

Table IX includes the division by slopes. The western slope is fully represented except for the omission of the Pit and McCloud basins in the north and the

TABLE IX.—VARIATION IN RUN-OFF BETWEEN STREAMS ON SAME SLOPE OF SIERRA NEVADA (APRIL-JULY PERIODS)

(Per Cent of Normal)

Side of Range	Basin	Year 1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19
A. East Side:											
Central Sierra (80 miles)	Tahoe[1]	73.85	172.29	55.76	67.68	151.60	88.76	111.20	127.40	62.61	81.99
	Carson	64.14	176.70	42.43	57.18	162.95	93.33	125.71	128.65	61.31[2]	66.58
	West Walker	96.57	150.58	56.23	50.96	...	...	119.98	106.85	81.95	70.34
	Max. variation	32.4	26.1	13.8	16.7	11.4	4.6	14.5	21.8	20.6	15.4
B. West Side (440 mi.)	Sacramento	71.0	112.2	80.2	79.0	115.8	141.3	81.5	91.0	53.0	69.8
1. North Sierra (Approx. 150 mi.)	Feather	60.7	183.7	46.2	69.2	123.5	139.5	115.7	114.1	47.0	72.8
	Max. variation	10.3	71.5	34.0	9.8	7.7	1.8	34.2	23.1	6.0	3.0
2. Central Sierra (approx. 150 mi.)	Yuba	66.67	146.10	56.58	68.10	112.61	117.27	111.87	104.93	47.67	70.82
	American	77.58	184.12	56.20	60.13	109.25	124.04	110.88	110.10	53.46	76.85
	Mokelumne	79.95	168.22	53.24	51.84	113.75	109.01	109.35	113.54	63.64	75.29
	Stanislaus	74.31	163.92	49.80	44.14	105.16	105.46	110.32	109.74	60.65	61.09
	Tuolumne	76.49	150.66	59.82	59.49	113.17	105.65	102.33	107.95	73.12	67.21
	Max. variation	13.3	38.0	10.0	24.0	8.0	18.6	9.5	8.6	25.5	15.8
3. Southern Sierra (approx. 140 mi.)	San Joaquin	82.4	176.1	55.1	42.7	136.9	104.2	131.3	97.2	76.4	60.1
	Kings	78.8	142.3	52.8	49.7	123.8	101.7	150.1	97.5	77.2	60.2
	Kaweah	50.0	116.4	53.1	53.9	98.3	95.8	151.3	105.8	55.1	66.0
	Kern	87.6	174.1	62.5	52.6	170.3	113.0	390.3	139.1	83.1	76.5
	Max. variation	37.6	57.9	9.7	11.2	72.0	17.2	259.0	41.9	28.0	16.4
	Max. variation, excl. of Kern	32.4	57.9	2.0	11.2	38.6	8.4	20.0	8.6	23.1	5.9
Max. variation of West Side		37.6	71.9	34.0	36.3	72.0	45.5	177.5	48.1	36.1	16.8
Foot-hill Streams:											
(1) West Side											
2. Central Sierra	Cosumnes	77.23	218.65	62.88	57.24	91.34	153.42	114.48	142.02	64.72	72.0
3. Southern Sierra	Tule	58.7	112.8	63.2	37.7	95.5	154.3	207.3	147.8	36.2	65.8

[1] The rise of Tahoe has been corrected for excess or deficiency of precipitation upon its surface to make more comparable with the run-off of the streams.
[2] At Clifton, 21 miles below empire, where measurements are usually taken. Correction probably +5.0 per cent.

Merced basin in the south. The eastern slope still lacks the minor basins of Honey Lake and Goose Lake in the north and the long Owens basin in the south. The foothill streams, being fed only to a minor extent by snow, are segregated from the rest. The primary peak of their flow occurs in midwinter, and only occasionally does their April-July run-off correspond closely with that of the crest streams.

If the run-off of the twelve major streams on the western slope were represented graphically, there would be a curve varying from end to end annually from 16.8 per cent to 308.8 per cent. The latter represents the season of 1915-16, when the snow cover increased from 81.5 per cent in the upper Sacramento basin at the northern end of the range to 390.3 per cent in the Kern basin at the far southern end, and disastrous floods occurred at San Diego.

If the slope is divided into three sections of approximately 150 miles each, the extreme annual variation in each would be somewhat reduced: Northern section, 1.8 to 71.5 per cent; central section, 8 to 38 per cent; southern section, 9.7 to 259 per cent, the latter occurring the year of the flood. If the Sacramento and Kern

FIG. 3. SNOW SURVEYING IN DAGGETT'S PASS, SIERRA NEVADA

basins, situated at the extreme ends of the range, are treated as parts of new sections, the variations in the northern section, when the data for the Pitt and McCloud basins are included, should be less than at present, and in the southern section the variation will be reduced to the reasonable extremes of 2 to 57.9 per cent. Finally, and of greatest importance for forecasting, the individual percentages for several adjoining basins represent, with occasional exceptions, a fairly uniform curve of change, not only within the several sections but also overlapping from one section to another.

Even closer uniformity exists on the eastern slope, if the rise of Lake Tahoe is corrected for excess of deficiency of precipitation upon its surface to make the run-off in its lake basin more comparable with that in river basins. The variation might be even smaller if corrections were made for evaporation and diversion of water in the Tahoe and Carson basins respectively.

Likewise, if a cross-section of the two slopes is taken, a similar uniformity in the snow fields, with occasional variation, is shown by the streams that head in a common summit but flow down the range in opposite directions. Unfortunately, all examples are confined as yet to the Central Sierra section. In the Tahoe-Yuba-American basins the extreme annual variations are 0.3 to 42.4 per cent; in the Carson-Mokelumne-Stanislaus basins, 2.3 to 57.8 per cent, and in the West Walker-Tuolumne basins, 0.1 to 20.1 per cent. In this last case, data are lacking for the year of probable maximum variation. Table XI furnishes details of the records.

Oscillation in the Snow Cover—The second marked characteristic of the snow cover, as shown by the flow of the streams, is its occasional heavy oscillation along or across the range. A striking illustration of the former is the continuous and frequent zigzag in the seasonal percentage between the basins along the western side of the Sierra Nevada in 1910-11, when the maximum variation even within the individual sections was at its peak of 38.0 to 71.5 per cent. Another illustration is the sudden upward sweep in the Kern basin of 72 per cent from the neighboring Kaweah basin in 1913-14 and 239 per cent in 1915-16.

Oscillation across the range is illustrated by the diversity in the stream flow in the Central Sierra section in 1913-14. Although the maximum oscillation along the range, as measured on the western side, was only 8.1 per cent, the oscillation across the axis in the three several groups of basins varied from 42.4 to 57.8 per cent, the excess being uniformly on the eastern side.

Quadrangles in Forecasting—On the basis of stream flow, both uniformity and oscillation over the range can be detected and forecast most accurately by dividing the range into a series of quadrangles, the length of each quadrangle according, theoretically, with the length of oscillation. Practically, the quadrangle should be sufficiently short to keep the normal oscillation within reasonable magnitude without regard to its overstepping from one section to the other. The width of the quadrangle should be sufficient to include all foot-hills above the elevation of 6,000 to 7,000 ft. on both sides

FIG. 4. SAMPLING SNOW AT HEAD OF WARD CREEK

of the crest, in order to furnish as long a transverse base line as possible. Crest stations with outposts on either side should be maintained to reveal any deviation in the seasonal percentage either along or across the range. Each basin should be represented by one or more crest stations, the number depending upon the size of the basin or the reliability of the station.

In the California-Nevada co-operative survey, three quadrangles have been formed. The oldest is the Central Sierra quadrangle comprising the Tahoe, Carson and Walker basins on the eastern slope, and the Yuba, American, Mokelumne, Stanislaus and Tuolumne basins on the western slope. Crest stations representative of the entire quadrangle have been established, with outposts along the eastern side, four of the latter being situated on the crest of the Carson range, which forms the eastern wall of the Tahoe basin. On the western side, outpost stations have been established thus far only in the Yuba basin in the northwestern part of the quadrangle.

The southern quadrangle should include all crest basins from the Merced or San Joaquin basin to the Tehachapi Pass, thus comprising the Kings, Keweah and Kern basins on the west and the long Owens basin on the east. Special attention must be devoted to the surveys in the complex Kern basin, which includes the long trough between the double crest of the high Sierra and the broad valley adjoining the Mojave desert. The Northern quadrangle will comprise probably the Feather, McCloud, Pit and upper Sacramento basins

TABLE X. SIMILARITY OF SEASONAL PERCENTAGES OF SNOW COVER IN ADJOINING BASINS

Season	Basins, Each Represented by One Central Station— Yuba (Summit Station)	Tahoe (Rubicon Peak)	Carson (Blue Lakes)	Walker (Cirque Mountain)
1917–18	82.5	90.6	96.4	
1918–19	107.1	95.5*	96.8	97.0
1919–20	71.6	73.3	75.3	88.2

* The average of the three crest stations, Ward Creek, Rubicon Peak, and Lake Lucile, is 104.7.

on the west and the two minor Honey Lake and Goose Lake basins on the east. The mountains are relatively low and without commanding crests, and outpost stations are difficult to obtain. However, the snow fields of Mount Shasta and Lassen Buttes may prove to be a factor of considerable proportions in helping to forecast the flow.

Foothill Streams—Forecasting the run-off in the foothill streams is a special problem, like forecasting the run-off from the San Gabriel mountains in southern California. It is complicated by the fact that these streams are fed by winter snow, which, although accurately measured in catch basins, is unstable in its melting, and by rains which begin to run off immediately. This forecast can be only short in its extent and subject to revision according to the rainfall and to the melting of the snow.

In inaugurating the snow survey of a basin or drainage area, the initial steps should be to determine the chief tributaries of the draining stream and to locate headwaters of Mary's River and North Fork. The courses planned for the larger streams in each group will serve probably for the smaller streams as well.

Since the two groups of courses are 80 miles apart, local observers should make the surveys in their respective localities. If the survey is made by one party, it should be made first along the northern feeders, where the watershed is not only lower but is gentler and faces the sun, rather than along the southern feeders, where the ridges are sharp and the slopes are protected. The feasibility of such a system has been proved by the establishing of as few as three courses in 1919 by the Nevada section of the U. S. Weather Bureau and the use of two of them during the past season in furnishing a satisfactory forecast of the April-July flow of the Humboldt basin.

An example of another type is the Bow River basin of Alberta, Canada, where the Canadian Meteorological Service inaugurated snow surveys in 1917. This basin is so alpine at its head in the Glacier National Park that a survey by the method of areas is physically impossible and even a survey by the method of seasonal percentage is difficult because of the difficulty of finding sites for stable courses. But an adjacent smaller basin of gentler contours has a snow cover closely representative of that in the larger basin. Consequently, the seasonal percentages in the smaller basin can be safely applied to the stream flow of the Bow River basin also.

In basins reaching far down from the crest of the

TABLE XI. VARIATION BETWEEN RUN-OFF OF STREAMS ON OPPOSITE SLOPES OF SIERRA NEVADA, BUT HAVING A COMMON SUMMIT APRIL-JULY PERIODS

(Percentage of Normal)

Group	Basin	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19
I—North	Tahoe[1]	73.85	172.29	55.76	67.68	151.60	88.76	111.20	127.40	62.61	81.99
	Yuba	66.67	146.10	56.58	68.10	112.61	117.27	111.87	104.93	47.67	70.82
	American	77.58	184.12	56.20	60.13	109.25	124.04	110.88	110.10	53.46	76.85
	Max. variation	7.2	26.2	0.8	7.6	42.4	35.3	0.3	22.5	14.9	11.2
II—Middle	Carson	64.14	176.70	42.43	57.18	162.95	93.33	125.71	128.65	61.31[2]	66.58
	Mokelumne	79.95	168.22	53.24	51.84	113.75	109.01	123.28	113.54	63.64	75.29
	Stanislaus	74.31	163.92	49.80	44.14	105.16	105.46	110.32	109.74	60.65	61.09
	Max. variation	15.8	12.8	10.8	13.0	57.8	15.7	15.4	18.9	2.3	14.2
III—South	West Walker	96.57	150.58	56.23	50.96			119.98	106.85	81.95	70.34
	Tuolumne	76.49	150.66	59.82	59.49	113.17	105.65	102.33	107.95	73.12	67.21
	Max. variation	20.1	0.1	3.6	8.5	.....	.....	6.7	1.1	8.8	3.1

[1] Corrected for rainfall on surface of the lake.
[2] At Clifton, 20 mi. below Empire, where measurements are usually taken. Correction, therefore, is probably +5.0 per cent.

snow survey courses at points of major flow. In this way a large basin can be served with a minimum of effort. For example, the Humboldt basin in Nevada has a length of 350 miles and a drainage area of 14,200 sq.mi. above Humboldt Lake, which receives its residual waters. But its run-off can be determined fairly well from four stations strategically placed in the Ruby and Charleston-Independence mountains, these being parallel ranges 80 miles apart which furnish approximately 90 per cent of the water of this basin.

The supplies from these two ranges bear approximately the ratio of 3:2 in favor of the higher and more rugged Ruby range. Of the feeders from the other mountains, Mary's River and North Fork furnish 84 per cent of the total run-off on that side, and of the three from the Ruby mountains, Lamoille Creek and South Fork furnish 86 per cent from their group. Furthermore, South Fork furnishes twice as much water as Lamoille Creek. On this basis, there should be four groups of snow courses: Two in the Ruby range, one each along South Fork and Lamoille Creek; and two in the Charleston-Independence mountains, along the range, crest and outpost stations should be established, the latter at a sufficient distance from the former to give a fair average of seasonal percentage at the two extremes of the basin.

Developing a Normal—In the absence of a normal for either snow cover or run-off, a simple process is to obtain data for the current snow cover and stream flow and apply them provisionally as a standard to the data obtained during the second and immediately succeeding years, until such time as a normal can be computed. Care should be taken to determine whether the run-off of this first or standard year has been abnormally affected by lack of normal precipitation or by other variable factors after melting began, for otherwise the resulting error would be perpetuated.

If rainfall measurements in the basin are not available, use should be made of those nearest or most reliable, for lack of rain sufficient to cause extreme variation in the run-off will be a general rather than a local phenomenon. If a satisfactory normal for stream flow is already at hand, so that the seasonal percentage of the first year is definitely known, this percentage can

be considered as that of the snow cover also, providing that no abnormal shrinkage in the former has occurred. From this percentage, the normal of the snow cover can be obtained at once.

A capital example of such pioneering is furnished by a recent experience in the Humboldt basin. The courses were one year old and some melting had occurred before the original measurements could be made. Further, the succeeding stream flow, measured by the U. S. Geological Survey, had not been announced. On the assumption that the melting was 3 in. of water (based on observations in the Sierra Nevada), the original measurements were increased by this amount and were then used as a standard of comparison for the present season. On this basis, the snow cover of the present season was found to be 76 per cent of that of the preceding season. On the other hand, there had been a probable shrinkage of 25 per cent in run-off the preceding season due to general lack of precipitation, which might not occur the present season. Consequently, a forecast of stream flow approximately equal to that of the preceding season was made, but owing to weather conditions this was reduced in the May forecast to 91 per cent.

Although no definite statement of the acre-feet available could be made, the comparison with conditions the previous season was even more comprehensible to the irrigationist, who still had a vivid recollection of its dryness. Later, the stream flow for 1918-19 (April-July) was announced as 115,690 acre-ft., or 49.6 per cent of normal The estimate for the present year was immediately changed to 45.1 per cent or 105,278 acre-ft. The actual run-off was 105,950 acre-ft. or 45.4 per cent.

A provisional normal can be based on as few as three seasons' measurements, providing the seasons are complementary. Thus, in the Tahoe basin the seasons 1909-12 and 1912-15 consisted of a heavy, an average and a light snowfall each, and their normals for crest and eastern outpost stations, measured in inches of water, bear the following close resemblance to each other and to the six-year normal:

	1909–12 (3 Years) In.	1912–15 (3 Years) In.	1909–15 (6 Years) In.
Crest	45.09	42.99	44.04
Eastern outpost	26.14	27.02	26.56

This rare occurrence has not been repeated and only recently is the average of the snow covers since 1915 approaching normal.

Years of very excessive snow cover or run-off should be omitted in forming a normal, unless the normal is based upon a very large number of years. Otherwise, the "reasonable expectation" will be set too high and chronically sub-normal years will result. For this reason, in all computations made in the Sierra Nevada surveys, seasons above 200 per cent have been omitted temporarily. Such high records include the rise of 225 per cent in Lake Tahoe in 1906-07 and the tremendous flows in the Kern River or 345.4, 302.7, and 390.3 per cent in 1905-06, 1908-09, and 1915-16 respectively. If the floods of the Kern are included in its normal, emotionalism must be considered as its normal habit.

Spring and Summer Precipitation Stations—In each basin, precipitation gages sheltered from the wind and of sufficient capacity to catch either snow or rain should be centrally located to determine the average precipitation over its area during the period of melting and late summer and autumn run-off. A gage at a central settlement will usually suffice, but occasionally a seasonal gage set farther into the basin will be more satisfactory.

Forecasts—Three forecasts of run-off each season will meet all ordinary needs, except when reservoirs are used for the dual purpose of flood catchment and irrigation storage. Then surveys and forecasts should begin with the first heavy snowfall and continue at intervals throughout the season. The first forecast is made early in April and represents merely the seasonal percentage of the snow cover at its maximum stage before melting has set in. The second is made early in May, when the probable effect of weather on the run-off can be anticipated and the estimate of probable run-off corrected for abnormal shrinkage. The third is issued early in June, when the run-off of April and May furnishes a clue to the balance available.

Additional snow surveys, made early in May and in June, indicate the relative amount of snow still unmelted and when a normal for melting has ultimately been obtained these surveys will furnish a check on the forecasts. These later surveys need be made at only a few central stations, but the courses should preferably be on level ground to indicate average conditions of melting at their altitude. Fig. 3 shows a snow survey party and Fig. 4 an observer weighing the water content of snow samples.

Temperature has such an immediate effect upon the run-off that it is always a disturbing factor in attempts to forecast the rate of run-off for any considerable period, although it has little effect on the ultimate net quantity delivered. In the case of reservoirs and lakes whose normal decrease from maximum stage due to evaporation is known, forecasts of available water for irrigation and power can be made with fair certainty until autumn when the new season's storms begin.

Organized Effort Essential

Single-basin surveying is sometimes unavoidable, but larger public service with increased accuracy and relatively decreased expense can be rendered by wide-area surveying with a central agency directing the work. In other words, organized effort or co-operation is more advantageous than individual effort. In this way overlapping can be avoided. Furthermore, early knowledge of the latent water resources of the range would permit power companies in deficient basins to make adjustments by "tying-in" with their more fortunate associates.

With the desire to conserve and harmonize its resources of land and water, the State of California, under the initiative of Major P. M. Norboe, chief assistant state engineer, has joined with Nevada and the Nevada section of the U. S. Weather Bureau (the last entering under the initiative of H. F. Alps) in establishing co-operative snow surveys throughout the two states, particularly in the part of the Sierra Nevada which is common to both. Power companies, such as the Pacific Gas & Electric Co. (the largest producer of power on the Pacific coast) and the Truckee River General Electric Co., are sharing in the work. Government bureaus and individuals also are rendering assistance.

To the Nevada plan of snow surveying has been added the California plan of the dual-use reservoir and the despatchership of streams. This involves the use of large catchment basins for the discordant purposes of flood control and storage for irrigation and power. The

combined plan will require a knowledge of snow storage and flood possibilities, initially to determine whether a reservoir in any particular season can be kept empty throughout the winter and yet be filled in the spring, but ultimately to determine how the reservoir can be used to full capacity, yet with safety against floods.

Cost of Snow Surveys—The cost of surveying a basin depends upon its number of courses and their accessibility. In the Tahoe basin, the "control" basin of the Central Sierra section, with its seven stations and a circuit from Reno of approximately 230 miles by train, auto, ski, sledge and motor-boat, the April survey requires the equivalent of thirteen days by a party of two persons, or proportionately less by the three parties that usually do the work. In the Yuba and Carson basins, four to six days are required. But in the Walker basin, ten days of strenuous effort and 100 miles of snowshoeing are necessary to cover the two forks and reach the almost inaccessible crest station between the Walker and Tuolumne rivers.

Surveys in May, because of their relative fewness, require far less time, being confined mainly to the crest stations in the Carson, Tahoe and Yuba basins. The maximum wages per day are usually $10 for chief of party and $5 for assistant, the amount being paid as a bonus to mountaineers who have other sources of income. Traveling expenses also are paid. The cost of maintaining a central precipitation station should not exceed $25 a month from April to November inclusive.

The present problem is to penetrate the higher basins of the Sierra Nevada sufficiently far to make an accurate determination of their snow cover, the proportions of which are indicated better by the winter run-off than by the winter rain or snowfall at the valley stations below. To accomplish this penetration, chains of refuge huts a day's march apart can be constructed and provisioned. The only requirement would be a preliminary winter reconnaissance to find sites where the snow lies sufficiently shallow to permit entering the cuts without effort.

Creosoted Wood Pipe in Use 28 Years

Creosoted wood pipe culverts put in place in 1892 by the Southern Pacific Railway Co. are still free from decay and the wood in perfect condition, according to a statement by E. J. Bartels in a recent paper before the American Wood Preservers Association.

Coal Cars of 120 Ton Capacity for Virginia Railway

TO HANDLE heavy traffic in coal for export the Virginian Ry. has adopted a type of steel gondola car having a load capacity of 120 tons, the rated load being 109 tons with the usual allowance of 10 per cent overload. These cars are operated only in solid trains and on the company's lines. As they are unloaded by car-dumping machines on the coal shipping docks no bottom doors or hoppers are provided and the sides are made smooth to give a uniform bearing in the unloader cradle. Stiffener angles and gussets are placed on the inside and the short end panels of the sides are recessed so that the ladders and grab irons do not project beyond the normal surface of the car.

COAL CAR OF 120-TONS CAPACITY FOR VIRGINIAN RAILWAY CAR-DUMPING MACHINES

In inside dimensions the cars are 49½ ft. long, 10¼ ft. wide and 7½ to 8½ ft. deep, giving a cubic capacity of 3,840 cu.ft. level full or 4,450 cu.ft. with coal heaped up at an angle of 30 deg. The empty car weighs a little less than 40 tons. Six-wheel trucks with 33-in. steel wheels are used, the truck frames being articulated over the middle axle to permit of vertical deflection. These cars were designed and built by the Pressed Steel Car Co., Pittsburgh, Pa., under the direction of R. E. Jackson, superintendent of motive power of the Virginian Ry.

The Traffic of New York City

A traffic survey made by the National Automobile Chamber of Commerce, facts gathered by the New Jersey Interstate Bridge and Tunnel Commission and some by the Department of Plant and Structures, New York City, set forth some astonishing statistics regarding the daily traffic into New York City, says a recent bulletin from the New York Municipal Reference Library. A total of 154,700 cars and trucks enter and leave Manhattan daily. The average number of passengers carried per car is 2.7 and the average load is 1.14 tons. The traffic across the bridges is very heavy, at some hours as high as 1,344 vehicles per hour, and even a greater proportion of truck travel is found on the Jersey ferries. During a 24-hr. count on 15 ferries the motor trucks numbered 7,482. It is estimated that 420,000 persons use automobiles to travel back and forth to the city, which is an equivalent of almost one-third of the travel daily on the Interborough subways. These figures do not include the passenger cars within the city borders.

Spring Valley Water Co. Purchase Strongly Recommended

IN a report submitted last December to the San Francisco Chamber of Commerce, but just made public, J. Waldo Smith, chief engineer of the Board of Water Supply of the City of New York, strongly recommends the purchase by the city of San Francisco of the works of the Spring Valley Water Co. In any event he urges that steps be taken to insure the earliest possible increase in the volume of water supply available since "San Francisco's life, health and progress are imperiled by the present condition of the water supply."

Mr. Smith considers as very fair to the city the value of $37,000,000 for the property of the company as placed by the Railroad Commission.

Regarding the water-supply needs of San Francisco and the reasons why the city should own the waterworks Mr. Smith says:

The stored water in the Peninsula and Alameda sources of the Spring Valley Water Co. has been reduced in the last five years of low rainfall, so that the recurrence of another dry season similar to that of 1920 will result in all the reservoirs being practically empty, a condition which would require the unthinkable remedy of rationing water—a hardship and a risk to which no one officially responsible should subject the people.

This menace is further emphasized by the fact that the water company has exhausted every expedient to reduce waste and to conserve its supply to the fullest possible extent. The slack is now all out, and the consumption is increasing at a normal rate. The present margin between safe available supply and demand is very narrow.

Within less than three years the consumption will be greater than the supply, and the storage reservoirs under average conditions will be continuously depleted. In other words, the water supply will have to be run on the faith that the rainfall will be above the average for an indefinite period. The condition is now such that more water is the only remedy, and this must be secured quickly.

The Alameda sources are the only ones immediately available, because:

(a) It is physically impossible to complete the construction work necessary for the first installment of Hetch Hetchy water, even under stress, in less than seven years.

(b) The unprecedented conditions created by the war, for which no one can be held responsible or to blame, have about doubled the cost of construction work. The sum now required to complete Hetch Hetchy is beyond the city's present financial resources, even if other equally necessary improvements are neglected.

Unless the grave conditions recited above are temporarily relieved by early copious rains, the city or the company must proceed with emergency work that can be completed within one year from date, and which will add 5 to 10 m.g.d. to the supply.

For a permanent remedy, the completion of construction of Calaveras reservoir, with a conduit leading to the city, must be promptly begun and additional water made available to the city as soon as possible.

The Alameda sources, when developed to their capacity and operated as a unit with the peninsular sources, will, in my judgment, at least double the supply now used by the city. This will allow the continuance of the development of the Hetch Hetchy from Moccasin Creek to the city only at a rate which will permit of the introduction of the first installment of Hetch Hetchy water when all the peninsula and Alameda sources are developed and used to their fullest extent.

The mountain division of the Hetch Hetchy, including Moccasin Creek power house and equipment, should be completed as soon as practicable, so that the project may become income producing at the earliest possible date.

The serious condition above set forth is largely, if not wholly, due to the fact that neither the city nor the water company has been charged with full responsibility.

The water company for many years, due to litigation, insufficient funds, and because it was not a free agent, has been unable to make the needed additions. The city has likewise been unable to meet the situation. A point has been reached where one of two things must be done and done quickly: (1) The city must purchase the property of the Spring Valley Water Co.; or (2) The company must be relieved of any interference on the part of the city, assured of an income sufficient to finance large capital investments, and be made to shoulder the full responsibility of maintaining at all times an adequate and generally satisfactory water supply to the community.

The answer is so plain as should leave no doubt in the mind of anyone interested in the progress and well-being of San Francisco, that the water supply, which is as necessary to the life, health and prosperity of the people of the city as the air they breathe, should be municipally owned and operated, for the following reasons:

1. Water supply is the one public utility concerning which no questions are raised as to the wisdom of municipal ownership and operation. There is now no other large city in this country which does not own its own water supply. It is safe to say that there is no city above 200,000 population where the supply is not municipal. In fact, a large proportion of all the water supplies in the country, both large and small, are municipally owned. In general, the municipality has rendered good service in the operation and maintenance of this utility.

2. It is the only way to end the present impossible condition of divided authority and consolidate the whole water question under one head (obviously the company cannot buy Hetch Hetchy), so as to secure an orderly development as a whole, and assure continuity of plan and purpose. This is particularly important, as the water supply, more than any public utility, requires looking far to the future. Plans must be made far in advance, in order that there may be no serious shortage in the supply.

3. If the city does not purchase now, it is certain to do so in the future, and at an increased cost. Much higher rates will also be required in order that the company may finance necessary capital expenditures for making available additional water. The Railroad Commission has practically indicated in its report that it will grant a rate schedule sufficient for the company's financial needs.

4. The valuation placed on the property by the Railroad Commission is extremely favorable to the city and is fair and reasonable.

5. The city is not asked to purchase an obsolete plant in a bad state of repair. The Spring Valley Water Co. is a going concern, capable of rendering good service, and its properties can be developed sufficiently to provide the city with water for many years. The system has been designed with skill, constructed with care and conscientious attention to detail. Structures have been well maintained.

6. It would be an economic crime and ultimately result in bankrupting all concerned for the city to construct a new distributing system paralleling the Spring Valley and build costly reservoirs within the city and on the peninsula, where the company has already utilized the best locations.

7. It can be said without fear of contradiction that all engineers who have given serious thought to the Hetch Hetchy project, from its earliest inception, have considered the Spring Valley works an indispensable part of San Francisco's water supply. Now is the time to secure them. The present city engineer, as well as his predecessors, has often voiced this sentiment.

Contents of Library of Congress

The Congressional Library on June 30, 1920, contained 2,831,333 books and pamphlets, 166,448 maps and charts (pieces), besides nearly 1,400,000 entries under music and prints, making a total of nearly 4,300,000 listed items. The gain in books and pamphlets during the year 1919-20 was 120,177.

Highway Council Plans Intensive Study of Subgrades

By H. G. Shirley

Secretary, Federal Highway Council, Washington, D. C.

Extracts from an address delivered before the American Road Builders Association, Feb. 9-12, at Chicago.

PAVEMENT failures which occur on soils of high bearing power amount to 17 per cent, whereas under the same climatic and traffic conditions, with the same thickness of surfacing made of the same materials, on soils of low bearing power such as clay and adobe, the failures reach 70 per cent. On stable gravel and sand soils the failures decrease to 2 to 3 per cent.

The most important problems of highway transportation and construction that face the country at the present time are the determination of the weight of the moving load that can be carried and the bearing power of the different types of soils of the sub-grade. When these two factors have been determined, by making a reasonable allowance for impact due to speed, we can design the surfacing with an assurance that it will carry the load that has been specified.

The subgrade committee of the Federal Highway Council is cooperating with the U. S. Bureau of Public Roads, leading universities and colleges, state highway departments and testing laboratories in an effort to arouse interest in these subjects. The problems listed by the Council are: (1) Securing samples of the sub-grade materials at points where the failures have occurred and samples where failures have not occurred in the same vicinity under similar conditions; (2) Developing field tests for bearing power of soils; (3) making studies in drainage, using experimental sections of roads; (4) a study of chemical methods of subgrade treatment for increasing bearing value or preventing absorption; (5) a study of mechanical methods of sub-grade treatment; (6) a study of freezing and thawing on the volume and on the supporting properties of soils; (7) a study of the effect of moisture on the volume changes in soils; (8) a study of the transmission of pressure to the sub-grade, through different thicknesses and different types of surfacing; (9) a study to ascertain the practical classifications of subgrade materials; (10) special problems.

Grade Separation Progress at Detroit

ELIMINATION of grade crossings at Detroit, Mich., is making relatively slow progress, partly owing to the small amount of work being done and partly to the increase in number of grade crossings. From a paper read before the Michigan Engineering Society by John W. Reid, engineer of grade separation in the Department of Public Works, the following information is taken, supplementing articles in *Engineering News-Record* of March 13, 1919, pp. 501 and 511; July 8, 1920, p. 93, and Aug. 12, 1920, p. 334.

Early in 1920 the city endeavored to induce the railways to increase their annual expenditures for the work to $1,000,000, instead of the $200,000 provided by the present arrangement. This attempt was unsuccessful, as no agreement could be made on the proportion of the expense to be paid by the city. Under these circumstances another method of securing a more progressive program would be to press grade separation on lines which are not covered by the existing contracts and which have about eighty grade crossings. It is unreasonable to assume that these crossings must wait until the others are completed.

One of the principal aims originally was to secure separation of grades at crossings having street car tracks, of which there were 22 in 1900. Only 7 of these have been eliminated, but in the meantime 25 new crossings have been added by the extension of the city limits and the extension of street car lines, making a total of 40 crossings yet to be handled. Further, the completion of the new municipal street railway lines will add 29 crossings, increasing the total to 69.

The long controversy over the Dequindre St. line of the Grand Trunk R.R. from the Brush St. station to Ferry Ave. was settled by the Public Utilities Commission in an order issued July 30, 1920, approving the city's plan for track depression from Jefferson Ave. to Gratiot Ave. New plans and estimates are now being prepared and must be submitted to the Commission before the final order is issued. In conjunction with work now being done by the railways at Lovernois Ave., Dix Ave. and Waterman Ave. the city will construct a subway at Military Ave. at a cost of $375,000 to extend this street across the Michigan Central, New York Ceneral and Wabash railroads at that point. As the city has directed the widening of Livernois Ave. from 66 ft. to 100 ft. it will pay about $100,000 for the additional expense due to this widening.

If the city could make an agreement with the railways for annual expenditures large enough to insure proper progress it might be wise to make this cover the entire city and to have the city assume a larger proportion of the cost. Such expenditures might be $2,500,000 or $3,000,000 annually for five years and $1,500,000 annually until the completion of the work. The reason for advocating so large an annual expenditure for five years is the great need of these improvements for safety and the relief of traffic conditions.

James B. Eads, Engineer-Architect, in Hall of Fame

AS a result of the fifth quinquennial election of members to the Hall of Fame located at New York University, New York City, James Buchanan Eads was chosen as an addition to the engineer-architect class. He received 51 votes against 11 for Henry Hobson Richardson, architect, and 12 scattering. Eads received exactly the number of votes (51) to elect him from the M. J. F. list (more justly famous). Otherwise 68, or two-thirds of the 101 possible, votes would have been required. Augustus Saint Gaudens (also marked M. J. F.) was chosen by 67 votes in the musician-painter-sculptor group. No one in either the scientist or the inventor class had a sufficient number of votes for election. The scientist vote stood: Samuel Newcomb (M. J. F.) 44; Benjamin Thompson (M. J. F.), 38; Samuel P. Langley and Matthew F. Moury, each 20; scattering, 18. For inventors the votes were: Cyrus H. McCormick, 43; Charles Goodyear, 16; John Ericsson, 10; scattering, 22.

In announcing the results of the vote the following biographical note relating to Eads was sent out by the Senate of New York University:

"James Buchanan Eads, American engineer, was born in Lawrenceburg, Ind., May 23, 1824, and died in Nassau, New Providence, March 8, 1887. He began life as a clerk in a dry goods house in St. Louis, Mo., in 1833 and then secured work on a Mississippi steamboat in 1839. He early designed some useful boats for raising sunken steamers, and in 1861 when called to the aid of the Federal Government, he constructed within 100 days eight ironclad steamers for use on the Mississippi and its tributaries. He afterward built a number of other ironclads and smaller boats which were of considerable service to the North. He built an arched bridge across the Mississippi at St. Louis in 1867-74. His work for improving the South Pass of the Mississippi Delta was successfully completed in 1875-79; and his great plan for deepening the river as far as the mouth of the Ohio by piers or jetties has been demonstrated to be entirely practicable. A later suggestion for the construction of a ship-railway across the isthumus of Tehuantepec attracted much attention. In 1884 he received the Albert medal of the Society of Arts, being the first American citizen to whom this honor had been awarded."

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

The Personal Pronoun Again

Sir—I should like to second the protest of Mr. Brady in your issue of Jan. 20 against the use of "the writer" or "the speaker" in place of "I." In spite of the practice of such famous engineers as Milo S. Ketchum, who avoids "I" whenever possible, authorities on technical writing are fairly well agreed that to say "the writer" in a signed article is really more self-conscious and affected than to say "I." T. A. Rickard, for instance, in his "Technical Writing," encourages a moderate use of "I."

If a writer begins saying "the writer," he must keep it up, to be consistent in that particular article, or else he must refer to himself as "he" and must refer to the party of which he was a member as "they." I remember once editing an article describing a trip to South America. The manuscript began somewhat like this: "The writer and his four assistants left New York on October 1. In three days they touched at Havana, where they secured a map of the island." Is it not silly to refer to the party of which one was a member as "they." Yet it is what follows when the third person is once begun by saying "the writer."

Some writers avoid "I" by using the passive and resorting to other awkward devices. Thus one engineer wrote: "The following report of the plant was made." This is indefinite. Did the engineer himself make the report, or perhaps his asistant, or someone else? When anyone talks of himself or writes his own opinions why not say "I"?

New York City, Jan. 21. P. B. McDONALD,
Assistant Professor of English,
College of Engineering, New York University.

Textbook of Iron and Steel Founding

REVIEWED BY DR. RICHARD MOLDENKE
Consulting Metallurgist, Watchung, N. J.

LEHRBUCH DER EISEN- UND STAHLGIESSEREI: Verfasst Fur Den Gebrauch Beim Unterricht, Beim Selbststudium Und in Der Praxis—Von Bernhard Osann, Ordentl. Professor An Der Bergakademis in Clausthal, Geh. Bergrat. Ehrenmitglied Des Vereins Deutscher Giessereifachleute. Vierte, New Bearbeitete Und Erweiterte Auflag. Leipzig, Germany: Wilhelm Engelmann. Paper; 7 x 10 in.; pp. 672; Illustrated. Paper; 42m. bound 54m.

The fourth edition of this standard work on foundry practice for Continental Europe is fully up to expectations so far as the information contained therein is concerned. The material is not conveniently arranged, the sequence of things the foundryman looks for in reading up the subject being very faulty. There is a wealth of foundry facts—some of them obsolete but still instructive. American practice has been drawn on freely with due credit given. Probably only in molding sand preparation will Europe be found ahead of us.

The usual topics are discussed; such as pig iron, coke, sand and supplies. The several melting processes, mixture-making, molding proper—with a big chapter on molding machine, the cupola, air furnace, crucible and open hearth—with the converter for steel—are gone into quite fully. The most interesting parts of the book are to be found in the discussion of the physical characteristics of cast iron, such as the shrinkage phenomena, chill, strength, fluidity, density, and the like. Similarly, the chemical side of the metal problems is well illuminated, and particularly the evil effects of oxygen cited. The author is weak in drawing comparisons between cupola and blast furnace methods for the foundry, as he himself is rather a blast furnace man.

The steel casting, then the malleable casting, foundry appliances, the foundry layout and foundry costs form the latter portion of the book, with a chapter on the metallography of cast iron to close it. On the whole, the book is well worth adding to the library of the foundryman and engineer able to follow the German text with understanding.

Unique Written Debate on Housing

THE HOUSING FAMINE: How to End It; A Triangular Debate Between John J. Murphy, Edith Elmer Wood, Frederick L. Ackerman. New York: E. P. Dutton & Co. Cloth; 5 x 8 in.; pp. 246. $2.50.

The participants in this unique triangular debate on the housing problem present much food for thought, but having each debater write three times on each of eight topis results in much repetition. The book would be far more useful if the entire argument were first summarized in about thirty pages. The detailed debate might then be presented in much more compact typographical form than is used in the book, with a great saving of time for many readers, as well as expense to publisher and purchaser.

Summarized briefly, Mr. Murphy, formerly tenement house commissioner, New York City, believes that relief for the housing famine may and should be secured by removing tariff and other taxation that raises the cost of building construction in general and by shifting much at least of the taxation from buildings to land. Mrs. Wood, who has given much study to housing, advocates state action in behalf of wage earners and particularly those receiving the lower rates of wages. This action would include study by federal, state, and city commissions; long-term loans at low interest rates to working men for house-building purposes; and federal and state construction of houses for the lower paid wage earners. She urges that Mr. Murphy's plan would be of little benefit to the wage earners who are in such dire need of housing and would increase the profits from all sorts of building operations. Mr. Ackerman, an architect who has devoted much time to city planning and to housing, places the whole blame for the housing shortage, high rents and many other ills on our industrial system, which, he says, is devoted to profit and not to production. He thinks the proposals of the other two debaters are at best mere palliatives in place of which he wishes to strike at the root of the whole evil. The other debaters repeatedly point out that this sort of talk has no bearing whatever upon the present housing situation since to put Mr. Ackerman's plan into effect would require a revolution of society and industry, which it would take many years to accomplish by the peaceful educational method that Mr. Ackerman seems to have in mind.

Marine Borers in Piling

REPORT ON THE SAN FRANCISCO BAY MARINE PILING SURVEY—By a Committee of the American Wood-Preservers Association. Published by the Committee: F. D. Mattos, Chairman, care of Southern Pacific Co., Oakland, Cal. Paper; 6 x 9 in., pp. 140; folding map, line cuts and half tone plates. $2.

Recent and unprecedented activity of marine borers in parts of San Francisco Bay led the American Wood Preservers Association to appoint a committee of 20 members to study borers and borer action there. The committee was composed largely of engineers and included representatives of railroads, the State Harbor Commission, the United States Forest Service, the United States Army and Navy, the University of California, companies engaged in timber preservation and engineers in private practice, as well as members of the Wood Preservers Association. The resulting report, based on four months of study late in 1920, reviews the subject under three heads: Hydrographic, biological and engineering. Of these the biological phase is justly given the lion's share of the space and illustrations. A distinctive feature of the report is that it uses the engineering instead of the zoological or biological viewpoint in describing how the several varieties of borers accomplished their destructive work, how the young travel to new fields and under what conditions they thrive. The many half tones showing the different borer species and their work will be welcomed by engineers who deal with timber structures in salt or brackish water.

Much of the report is chiefly of local interest because of the desire to deal with the San Francisco situation specifically. Here and there the committee shows a tendency to favor creosoted piles in preference to other materials. It would hardly be expected that a committee with a considerable percentage of its members engaged in timber preservation could do otherwise, and such phases of the report are only incidental and do not detract from the value of the facts presented. The report is a valuable addition to the scanty technical literature on marine borers.

Engineer, Author, Educator and Artist

SILVANUS PHILLIPS THOMPSON (D.Sc., LL.D., F.R.S.) HIS LIFE AND LETTERS—By Jane Smeal Thompson and Helen G. Thompson, B.Sc. New York: E. P. Dutton & Co. Cloth; 6 x 9 in.; pp. 372; illustrated. $7.50.

The biographers of the late Professor Thompson—presumably his daughters—have written a well-rounded and interesting life of a leading British electrical engineer who at the same time was notable as an author of a number of basic treatises and monographs on electrical engineering, and on sound and allied subjects, besides being throughout his entire mature life one of the foremost technical educators, an eagerly sought lecturer, and a draftsman and artist whose work attracted attention outside as well as within technical fields. In addition to his well-known "Elementary Lessons in Electricity and Magnetism," "Dynamo Electric Machinery," and "Calculus Made Easy" (the latter published anonymously until just before his death), Professor Thompson wrote lives of Philip Reis ("Inventor of the Telephone"), Faraday, and Lord Kelvin. He made various translations, wrote many technical papers and literary and religious essays and delivered numerous addresses. For many years and until his death he was principal of the Finsbury Technical College, London. He took a large part in reforming technical education in England. As a physicist, engineer, educator and devoted Quaker he kept in touch with American leaders in the same field. Professor Thompson's activities were many, his sympathies were broad, his culture notable. Altogether his life is a worthy addition to the altogether too small number of lives of engineers.

Practical Aspects of the Labor Problem

LABOR'S CRISIS: An Employer's View of Labor Problems—By Sigmund Mendelsohn. New York: The Macmillan Co. Cloth; 5 x 8 in.; pp. 171. $1.50.

It is a hopeful sign of the times when an employer of labor writes so thoughtful and sympathetic an essay on current labor problems as this one.

The author argues against reduced hours of labor, except as this results in increased efficiency, and he also expresses himself against "a legislated minimum wage." He favors profit-sharing, better housing and labor welfare work, reasonably conceived and conducted. He thinks the present labor unrest "will, among other revolutionary changes, restore as a productive factor the importance of the factory village and small industrial town" and "lessen the drift from the rural district to the large labor centers."

Modern Medicine and the Public Health

The late Prof. W. T. Sedgwick's address, "Modern Medicine and the Public Health," delivered at the centennial celebration of the Medical College of the University of Cincinnati, Nov. 6, 1920, is printed in *Public Health Reports* (Washington, D. C.) for Jan. 28.

PUBLICATIONS RECEIVED

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS: Transactions, Vol. XII, Part II, 1919. New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 263; illustrated. $5.

CANADIAN MUNICIPAL STATISTICS: Report on Cities and Towns Having a Population of 10,000 and Over—Prepared by Lt.-Col. J. R. Munro, in charge of Finance Division of the Bureau. Ottawa, Can.: Dominion Bureau of Statistics. Paper; 7 x 10 in.; pp. 57.
Returns from 53 cities giving population, assessed valuation, tax rates, miles of paved and unpaved streets, water-works, fire and police and financial data.

CANADIAN RAILWAY STATISTICS, 1919. Ottawa, Can.: Bureau of Statistics. Paper; 7 x 10 in.; pp. 267.

CAMS: ELEMENTARY AND ADVANCED—By Franklin DeRonde Furman, M.E., Professor of Mechanism and Machine Design at Stevens Institute of Technology, M. Am. Soc. M. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 234; illustrated. $3 postpaid (16/6 net.)
A combination of Prof. Furman's "Elementary Cams," published in 1916, and a new work, the "chief original features" of which are "the development or use, or both, of the logarithmic, cubic, circular, tangential and involute base curves, the establishing of cam factors for such of these curves as have general factors, and the demonstration that the logarithmic base curve gives the smallest possible cam for given data."

CAUSES AND PREVENTION OF FIRES AND EXPLOSIONS IN BITUMINOUS COAL MINES—By Edward Steidle. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 75; illustrated. 20c. from Superintendent of Documents.

CHARCOAL IRON—By Dr. Richard Moldenke. Lime Rock, Conn.: Salisbury Iron Corporation. Leatherette; 4 x 7 in.; pp. 64; illustrated. Limited number of copies available upon request.
Historical review and list of active furnaces.

STATISTICS OF CHINESE GOVERNMENT RAILWAYS, 1919. Peking, China: Ministry of Communications. Paper; 9 x 13 in.; pp. 50; illustrated.

CHRONOLOGY OF IRON AND STEEL—Compiled by Stephen L. Goodale, Ph.B., E.M., A.M., Professor of Metallurgy in the University of Pittsburgh; Edited by J. Ramsey Speer, S. B., Massachusetts Institute of Technology, Chairman of the Board, Pittsburgh Iron & Steel Foundries Co. Pittsburgh, Pa.: Pittsburgh Iron & Steel Foundries Co. Leatherette; 4 x 7 in.; pp. 294.
Contains interesting information regarding the manufacture of iron and steel and the progress of invention and industry affecting the demand for those materials, arranged chronologically from the earliest times to the close of 1919. Running back for several centuries there is at least one item recorded for nearly every year while for more than a hundred years past the yearly entries are generally numerous. The usefulness of the book is much increased by an extensive index.

COMPARATIVE RAILWAY STATISTICS, UNITED STATES AND FOREIGN COUNTRIES, 1916. Washington, D. C.: Bureau of Railway Economics. Paper; 6 x 9 in.; pp. 66.

CONCRETE WORK: A Book to Aid the Self-Development of Workers in Concrete and for Students in Engineering—By William Kendrick Hatt, C.E., Ph.D.; M. Am. Soc. C. E.; M. Am. Soc. T. M.; M. Soc. Prom. Eng. Ed.; President, American Concrete Institute, etc., and Walter C. Voss, B.S., Assoc. M. Am. Soc. C. E.; M. Am. Soc. T. M.; M. Am. Con. Inst.; Head, Department of Architectural Construction, Wentworth Institute, Boston, Mass., etc. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5 x 8 in.; pp. 451; illustrated. $4.

CRAIN'S MARKET DATA BOOK AND DIRECTORY: Class, Trade and Technical Publications. Chicago, Ill.: G. D. Crain, Jr., 417 S. Dearborn St. Cloth; 6 x 9 in.; pp. 462; illustrated.

EFFECT OF TANNIC ACID ON THE STRENGTH OF CONCRETE—By Duff A. Abrams, Professor in Charge of Laboratory. Chicago, Ill.: Structural Materials Research Laboratory, Lewis Institute. Paper; 6 x 9 in.; pp. 31; illustrated.

ELEMENTS OF MECHANISM—By Peter Schwamb, S.B., Professor of Machine Design (retired), Massachusetts Institute of Technology; Allyne L. Merrill, S.B., Professor of Mechanism, Massachusetts Institute of Technology; Walter H. James, S.B., Assistant Professor of Mechanical Engineering Drawing, Massachusetts Institute of Technology. Third Edition, Revised and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 372; illustrated. $3.50.

The first edition was reviewed in the Engineering Literature Supplement of *Engineering News*, Dec. 15, 1904, by Charles R. Pratt. This edition embodies many changes suggested by instructors who have used the second edition during the last 16 years.

EMPLOYMENT METHODS—By Nathan W. Shefferman, Consultant in Personnel and Employment Management; Formerly Personnel Director for Lycoming Foundry & Machine Co., etc. New York: The Ronald Press. Cloth; 6 x 9 in.; pp. 573; illustrated. $5.

FEDERATION OF BRITISH INDUSTRIES: Export Register, 1920. London, Eng.: The Federation of British Industries. Cloth; 7 x 10 in.; pp. 312; illustrated.

Members' names are first listed alphabetically, followed by list of products, home office and agents. Products are listed alphabetically, with names of makers of each following. Much of the space is filled with advertisements—members only.

FIRE TESTS OF BUILDING COLUMNS: An Experimental Investigation of the Resistance of Columns, Loaded and Exposed to Fire or to Fire and Water, with Record of Characteristic Effects by Associated Factory Mutual Fire Insurance Companies, The National Board of Fire Underwriters and the Bureau of Standards, Department of Commerce. Chicago, Ill.: The National Board of Fire Underwriters. Paper; 6 x 9 in.; pp. 389; illustrated. Paper $2; cloth $2.50.

GOVERNOR OF PORTO RICO: Report to the Secretary of War, 1920. Washington, D. C.: War Department. Paper; 6 x 9 in.; pp. 574; illustrated.

A HANDBOOK OF ARCHITECTURAL PRACTICE—Issued by the American Institute of Architects for Use in Connection with Its Standard Documents. Washington, D. C.: The Institute. Cloth; 8 x 11 in.; pp. 204.

HYDRAULICS OF THE MIAMI FLOOD CONTROL PROJECT—By Sherman M. Woodward, M. Am. Soc. C. C.; M. Am. Soc. M. E.; Consulting Engineer of the Miami Conservancy District; Professor of Mechanics and Hydraulics, State University of Iowa. Technical Reports, Part VII, The Miami Conservancy District. Dayton, Ohio: The District. Paper; 6 x 9 in.; pp. 343; illustrated. $1.

Describes hydraulic problems involved in selection of the types of improvement and in the final design of the works under construction.

HYDRO-ELECTRIC DEVELOPMENT IN ONTARIO: A History of Water-Power Administration Under the Hydro-Electric Power Commission of Ontario—By E. B. Biggar, Author of "Canadian Railway Problem," Former Editor of *Canadian Engineer*, etc. Toronto, Can.: The Biggar Press, Ltd. Cloth; 5 x 8 in.; pp. 202; illustrated. $2.

IDAHO DEPARTMENT OF PUBLIC WORKS: Report, 1920, Part I: Introduction, Capitol Construction, Capitol Maintenance, Bureau of Supplies, Heyburn Park; Part II: Bureau of Highways. Boise, Idaho: The Department. Paper; 6 x 9 in.; pp. 221; illustrated.

LABOR MAINTENANCE: A Practical Handbook of Employees' Service Work—By Daniel Bloomfield, of Bloomfield & Bloomfield, Consultants in Employment Management and Industrial Relations; Author of "Employment Management," etc. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 530; illustrated. $5.

MECHANICAL WORLD YEAR BOOK, 1921. Manchester, Eng.: Emmott & Co., Ltd. Cloth; 4 x 7 in.; pp. 319; illustrated. 2/6 net.

New sections in the present edition of this annual deal with cast-tooth gearing and ball and roller bearings. There is also new matter on friction and lubrication, chain gearing and saturated steam, besides various revisions.

MUNICIPAL ACCOMPLISHMENT IN CITY PLANNING: Published City Plan Reports in the United States—Edited by Theodora Kimball, Librarian, School of Landscape Architecture, Harvard University, Honorary Librarian, American City Planning Institute. From Information Assembled Largely by the Detroit City Plan Commission. Boston, Mass.: National Conference on City Planning. Paper; 6 x 9 in.; pp. 79. 40c.

Based on returns from 87 cities. Contains digest of planning work and list of planning reports for each city.

PHILIPPINE ISLANDS: Report of the Governor General to the Secretary of War, 1919. Washington, D. C.: War Department. Cloth; 6 x 9 in.; pp. 216.

POSSIBILITIES OF STEAM RAILWAY ELECTRIFICATION. Simla, India: Chief Engineer, Railway Board. Paper; 8 x 13 in.; pp. 84; illustrated. 4 Annas.

Although issued by the Railway Board of India the paper is not an "official" publication, but consists of three papers: The first on the feasibility of electrifying the suburban area of the Eastern Bengal Railway, by Messrs. Merz and McLellan; the second, a reprint of an article in the *Railway Gazette* and *Railway News* on "The Possibilities of Steam Railway Electrification," by Calvert Townley; the third, a report by A. R. Gundry, electrical engineer, Eastern Bengal Railway, on the electrification of various railways in England.

THE PRODUCTION OF IRON AND STEEL IN CANADA, 1919—By John McLeish, B.A., Chief of the Division of Mineral Resources and Statistics. Ottawa, Can.: Department of Mines. Paper; 7 x 10 in.; pp. 45.

THE PRODUCTION OF WHOLESOME WATER FOR MUNICIPALITIES—By L. O. Bernhagen, A.C., Editor, Texas Water-Works Association. Austin, Tex.: The Association. Paper; 6 x 9 in.; pp. 63; illustrated.

Designed for operators of filtration and disinfection plants without regular chemists or bacterologists. Covers sources of supply, sampling and analysis, apparatus and methods of treatment.

PROGRESS OF PURCHASE OF EASTERN NATIONAL FORESTS: Under Act of March 1, 1911 (The Weeks Law); Prepared by National Forest Reservation Commission. Paper; 9 x 11 in.; pp. 26; illustrated.

"The Weeks law," the report states, "was designed primarily for affording protection to the headwaters of navigable streams" by "the maintenance of forests."

PROPOSED CLASSIFICATION OF TITLES AND POSITIONS IN THE CIVIL SERVICE: Report of the City of Rochester, N. Y. Prepared for the Common Council's Special Committee on the Standardization of Salaries. Rochester, N. Y.: Bureau of Municipal Research, Inc. Paper; 6 x 9 in.; pp. 173.

QUALITY OF GASOLINE MARKETED IN THE UNITED STATES—By H. H. Hill and E. W. Dean. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 275; illustrated. 30c. from Superintendent of Documents.

RELATIVE ADVANTAGES OF MODERN STEAM AND ELECTRIC LOCOMOTIVES—By John E. Muhlfeld, M. Am. Soc. M. E., M. A. I. E. E. Address as Presented at the Joint Meeting of the Railroad, Metropolitan and New York Sections of the Mechanical and Electrical Engineering Societies. New York: Railway and Industrial Engineers, 29 Broad Street. Paper; 6 x 9 in.; pp. 65.

An abstract of this paper appeared in *Engineering News-Record*, Oct. 28, 1920, p. 853.

RUDIMENTS OF ELECTRICAL ENGINEERING—By Philip Kemp, M. Soc. Tech., M. I. E. E., Author of "Alternating Current Electrical Engineering," etc. New York: The Macmillan Co. London: Macmillan & Co., Ltd. Cloth; 5 x 7 in.; pp. 255; illustrated. $2.

THE SLIDE RULE: A Practical Manual—By Charles N. Pickworth, Whitworth Scholar, Editor of the *Mechanical World*, etc. Seventeenth Edition. New York: D. Van Nostrand Co. London: Emmott & Co., Ltd. Cloth; 5 x 7 in.; pp. 133; illustrated. 3/6.

Some new slides rules are described. "Slight revisions" have been made in this edition.

STANDARDS FOR GAS SERVICE. Washington, D. C.: Bureau of Standards. Paper; 7 x 10 in.; pp. 140. 20c. from Superintendent of Documents.

Résumé of state and city regulations of gas service, with discussion of technical requirements and recommended rules and ordinance forms. Earlier editions appeared in 1912-13-15.

STATE MINING LAWS ON THE USE OF ELECTRICITY IN AND ABOUT COAL MINES—By L. C. Ilsley. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 53; illustrated. 10c. from Superintendent of Documents.

STENCHES FOR DETECTING LEAKAGE OF BLUE WATER GAS AND NATURAL GAS—By S. H. Katz and V. C. Allison. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 22; illustrated. 5c. from Superintendent of Documents.

THE ST. LOUIS TRANSIT SYSTEM, PRESENT AND FUTURE—By Harland Bartholomew, Engineer, City Plan Commission. St. Louis, Mo.: The Commission. Paper; 7 x 10 in.; pp. 36; folding maps.

STORAGE BATTERY LOCOMOTIVES: Preliminary Investigations, Specifications, Laboratory Tests, Permissible Schedule—by L. C. Ilsley and H. B. Brunot. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 35; illustrated. 10c. from Superintendent of Documents.

STUDY RELATING TO THE WATER RESOURCES OF MISSOURI—By T. J. Rodhouse, Professor of Hydraulic Engineering, University of Missouri. Columbia, Mo.: Engineering Experiment Station, University of Missouri. Paper; 6 x 9 in.; pp. 57; illustrated.

TEXAS STATE HIGHWAY COMMISSION: Report 1918-20. Austin, Tex.: The Commission. Paper; 6 x 9 in.; pp. 104; illustrated.

TRADE ASSOCIATIONS: Their Organization and Management—By Emmett Hay Naylor, Secretary-Treasurer of the Book Paper, Cover Paper, Tissue Paper, and Writing Paper Manufacturers Associations; President, American Trade Association Executives. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 398; illustrated. $5.

Discusses purpose, structure and procedure of trade associations; also competition, co-operation, fair prices, and service rendered; has bibliography and also list of associations.

TRAINING INDUSTRIAL WORKERS—By Roy Willmarth Kelly, Manager of Industrial Relations for the Associated Oil Co. of California; Sometime Director of the Harvard University Bureau of Vocational Guidance; with an Introduction by John M. Brewer, Ph.D., Associate Professor of Education, and Director of the Bureau of Vocational Guidance, Harvard University. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 437; illustrated. $5.

UTILIZATION OF BLACK WALNUT—By Warren D. Brush, Scientific Assistant, U. S. Department of Agriculture. Washington, D. C.: The Department. Paper; 6 x 9 in.; pp. 89; illustrated. 30c. from Superintendent of Documents.

WASHINGTON STATE RECLAMATION BOARD: Report to the Governor and Legislature, March, 1919 to December, 1920. Olympia, Wash.: The Board. Paper; 6 x 9 in.; pp. 12; folding map.

WYOMING STATE HIGHWAY COMMISSION: Report, 1919-20. Cheyenne, Wyo.: The Commission. Paper; 6 x 9 in.; pp. 121; illustrated.

LETTERS TO THE EDITOR

It is the editors' desire to publish here all worthwhile letters pertinent to the interests of engineers and contractors. In order that this may be possible contributors are asked to condense their letters to the shortest space consistent with a clear presentation of their ideas.

Engineers and Political Appointments

Sir—Have with pleasure and approbation read the editorial in your issue of Jan. 27, p. 146, on the N. Y. State Governor's appointment to the office of Commissioner of Highways. It would be ideal to have merit and qualifications the only grounds for political appointments and for argument's sake I suggest that if some well qualified engineer had been as active politically as the appointee, the Governor might have seen his way to appoint the engineer. Our political parties are not built on any other procedure than that to the victor belong the spoils, and necessarily the captains and lieutenants see to it that the reward is commensurate with efficiency shown in a campaign. Take away the prospect of a fat political job as reward, and political organizations would soon go to pieces, as no one in the ranks is a bit interested in principles, no matter how much speakers are shouting about economy and business administration before election.

Look around a little and you will find the same conditions everywhere. Here in Cleveland the men at the head of the two construction departments are a lawyer and a clothing salesman. Therefore, under existing conditions, if engineers desire the administrative offices they will have to become prominent in politics, as it is only in that way—not as engineers—that they may hope for such appointments, however efficient and prominent they may be as professional men.

Your Governor is not to blame—he is only carrying out the wishes of those who elected him. It is not good politics to do otherwise, as witness the Democratic party, which in a good many places had no organization, because the President in some of his appointments ignored the local organization.

EDWARD HARRISON.

Cleveland, O., Jan. 31.

Another Illinois City Almost Scored a Typhoid Epidemic

Sir—An editorial, entitled "Leaky Cross Connection Kills Fifteen," in *Engineering News-Record*, May 13, 1920, p. 939, comments upon the typhoid epidemic at the Chicago & Alton R.R. shops at Bloomington, Ill., caused by a cross-connection between the city supply and a polluted industrial supply. As is customary, all possible publicity was given to this epidemic, and the usual effort was made to bring it before public officials in Illinois in order that they might learn from the sad experience of others. An article under the heading, "Will Cities Ever Learn from the Experience of Other Cities How to Protect Their Public Water Supplies?" appearing in *Illinois Health News* for April, 1920, and describing the cross-connection and epidemic was widely distributed.

Perhaps some cities have learned their lesson from Bloomington, but one more city in Illinois has had to learn from its own experience. This time it was Maywood, which has a population of about 12,000. The conditions were favorable for Maywood to make as good a score as other municipalities that permit dangerous cross-connections, but fortunately the result has been only about 75 cases of dysentery and no deaths. Nevertheless, the lesson was sufficiently severe for Maywood to profit by it, and now Maywood is a much safer place in which to live.

Maywood has an adequate supply of good water obtained from deep drilled wells near the center of the city. Located a few blocks from the pumping station on the banks of the highly polluted Des Plaines River is a power plant of the Public Service Co. of Northern Illinois. In the company's plant an interconnection with the city water-supply system existed, so that the company could use either city water or the polluted river water furnished from its own pumps. The river receives the sewage from several communities located from two to ten miles upstream. On Oct. 4, 1920, people residing on streets near the plant of the Public Service Co. noticed disagreeable tastes and odors in the water and reported them to the waterworks officials, but not until about 25 cases of dysentery had occurred the next day were complete investigations made, as a result of which the cross-connection was abandoned. In all about 75 cases of dysentery resulted, many of which were serious but fortunately did not develop into typhoid. All were located on three streets near the plant of the Public Service Co.

Maywood has learned its lesson, has gained some publicity and another report has been filed. Public and waterworks officials are advised in so far as possible of the dangers from such connections, but judging from past experience we can only wonder what city which permits cross-connections to continue will be the next to learn its lesson from its own epidemic.

HARRY F. FERGUSON,

Acting Chief Engineer, Department of Public Health.

Springfield, Ill., Jan. 25.

Am. Soc. C. E. Committee Chairman Picked on Merit

Sir—I note in your issue of Feb. 3, 1921, a letter from A. T. North, M. Am. Soc. C. E. of Chicago, asking for the reasons for the appointment recently of the chairman of "two very important committees by the Board of Direction of the American Society of Civil Engineers—the Committee on Constitutional Amendments and the Committee on External Relations."

While it is obvious that the board cannot undertake to answer general questions of this sort, it is perhaps proper that I, as the member of the board responsible for the suggestion of General Marshall as chairman of the second committee, should give my reasons for the selection, particularly as Mr. North implies a motive for the selection of these two men which did not exist.

Speaking first with reference to the Committee on External Relations, undoubtedly there are other men in the society who were perhaps available and would have made equally competent chairmen. I did not chance to think of them. General Marshall did occur to me as being a man of the type desired—well balanced, capable and energetic. He had made a splendid record for himself amongst engineers in his work in the Construction Division of the Army during the war, had demonstrated great ability as an administrator, had shown a very progressive and discriminating spirit and, what was much desired, had a large acquaintance amongst the younger, as well as the older, engineers of the country, which would enable him to gather information and conflicting points of view as rapidly as possible. The fact that he was a new member of the society and therefore not in touch with the recent issues within its membership, combined with the qualities stated, seemed to make him a very desirable choice. He knew nothing about his selection until he was appointed and asked to serve by the Board of Direction, and as a matter of fact was a good deal embarrassed by the request, as other pressing matters lay before him.

From the few comments which the writer has heard from members of the committee that served with him, as well as from members of the society generally, he has been led to believe that the choice was a fortunate one. In any event, it is to be regretted that any member of the society should call into question the motive in the appointment, or the character of the service rendered, as the appointment of this committee, and of its personnel, was directed solely by a desire to aid the incoming board with such constructive suggestions as might emanate from a group of men actively interested in the affairs of the society, in close touch and sympathy with the younger men of the society.

As to the appointment of the Committee on Constitutional Amendments, the writer is not advised, but from his knowledge of the fair mindedness, the experience and ability of the chairman selected, he feels the utmost confidence in his judicial approach to the very important work entrusted to him and in the outcome of the investigations of the committee. It must certainly have been apparent to all who attended the annual meeting of the society that this committee was deserving of full confidence and cordial support.

It is an unfortunate fact that lack of information on the part of the members of the American Society of Civil Engineers concerning the care and fidelity with which the Board of Direction approaches, investigates and acts upon its problems has led often to suspicion and unfair criticism. The conscientious manner in which the directors meet their obligations, busy men as they are, many of them coming long distances to attend the meetings at substantial personal sacrifice, is deserving of better recognition and support. Constructive criticism is always welcomed by the board, whatever may be the attitude of individuals on different questions. From five years of active service upon the board, recently ended, the writer has come to have a great respect for its methods of procedure and collective judgment and feels that the distruct of motive which has cropped out from time to time has generally been due to lack of intimate knowledge of its personnel, functions and procedure. It is to be hoped that with the composure of past differences effected at the last annual meeting of the society there may enter an era of better co-operation.

Boston, Mass., Feb. 9, 1921. LEONARD METCALF.

County and Township Bridges Under Motor Trucks

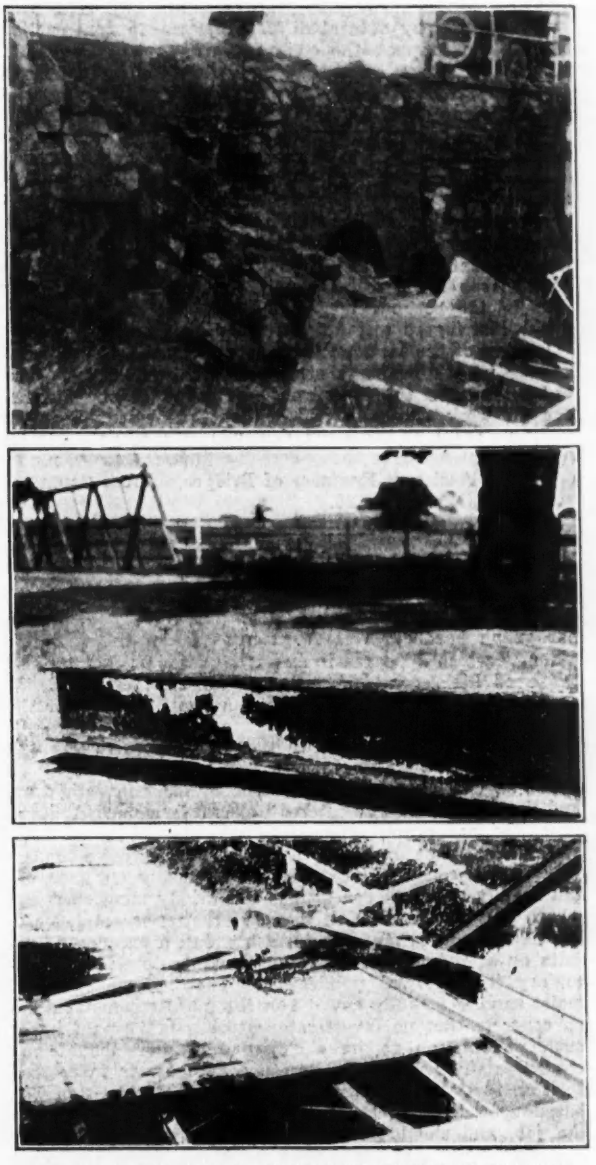
Sir—The presentation of the case of highway bridges by M. W. Torkelson, bridge engineer of the Wisconsin Highway Commission in *Engineering News-Record* of Jan. 13, p. 61, is worthy of commendation. Conditions depend on localities, however, and while Mr. Torkelson may be justified in his contentions concerning the safety of bridges within his jurisdiction, the writer feels that he has shown a tendency to minimize the menace presented by the general run of highway bridges.

Structures designed thirty to forty years ago to carry the loads of horsedrawn vehicles might be safeguarded by the use of capacity signs, but such signs confront the motor-truck driver with the prospect of a long detour, and in many instances he will take the chance and pay no heed to the warning. To make matters worse he will accelerate his speed on approaching the bridges with the hope that, in case of failure, his inertia will carry him beyond danger. Such conduct is responsible for many bridge failures and accidents, and the only way to avoid them is to make all structures strong enough to carry the loads that may come upon them. The bridge is an integral part of the highway and should be capable of functioning with the same degree of safety.

State bridges form a very small percentage of all, and by far the greatest burden falls upon county officials, who as a rule are handicapped by lack of funds and have inadequate bridge departments. At the present time state highway routes throughout the country are in the course of construction and this throws the heaviest possible traffic on county and township roads, the average live-load capacity of whose bridges is about 5 tons. When we consider that motor trucks having a gross weight of 15 and 18 tons are rather the rule than the exception the danger of such conditions is easily appreciated. By-roads may at any time and with little or no warning be called upon to act as main roads for a temporary period.

A few cases from practice may be cited to support my contention that highway bridges offer a serious problem, and that their menace must be removed at the earliest possible moment.

Where a bridge is at the foot of a steep grade and the designer thought it best to constrict the right-of-way at the bridge site the narrow width combined with the unfavorable grade has often been the cause of unfortunate accidents. One of these instances is illustrated by Fig. 1.



SERIOUS CONDITIONS IN COUNTY HIGHWAY BRIDGES

Upper—Culvert narrower than highway. Motor truck ran over the wing wall, knocking it down. Middle—One of a lot of corroded stringers taken from a 100-ft. truss span. Only by merest chance was their condition noticed and the stringers removed before an accident happened. Lower—Stringers too weak and not stayed; they buckled and tipped over under a truck, but the lower laterals held them up.

Incredible corrosion is sometimes found in the floor system of bridges that from the deck seem to be in perfectly good condition. The beam shown by Fig. 2 was taken from a 100-ft. span truss bridge, in which the trusses were in such an excellent state of preservation that it was possible to apply a concrete floor and asphalt-block pavement after the stringers were replaced, and remove any limitations to the allowable load. Without a well-organized bridge maintenance department such defective stringers may go unnoticed, especially where the under side of the bridge is not conveniently accessible, and sooner or later may result in the loss of life and property.

Bridge abutments are also a source of grave danger. They are subject to a variety of strusses and disruptive agencies, and unless properly designed and constructed will fail from scour, frost action, earth pressure or inadequate foundations. In a recent case in this county the abutment of a steel truss bridge was not only undermined by scour

but also pushed forward by the hydrostatic and earth pressures exerted by saturated fill subjected to frost action. It fell and dropped the end of the span into the water. A related defect of old highway bridges is inadequate waterway, and failures from this cause are too numerous to require any further comment.

Lateral weakness of stringers of the kind represented by Fig. 3 has proved troublesome in a number of instances in this county. The floor failure, due to overturning of the stringers, is chargeable to the lack of ties between stringers and insufficient connection to the floor beams. Of course the stringers themselves were too weak to carry the load safely, but if properly tied together they might have borne an overstress without buckling. The sway rods in the bottom chord bracing helped to support the buckled stringers and keep the truck on the bridge.

In view of the abundance of facts illustrating the glaring danger in our drainage structures, the writer feels that it behooves us to recognize the menace of our bridges, and to work earnestly and without abatement to make them adequate to meet the demands of modern vehicular transportation.

MORRIS GOODKIND,
Assistant Engineer of Bridges, Mercer County.
Trenton, N. J., Jan. 25.

More on Bulking of Sand

Sir—Referring to the discussion by Mr. King in the Jan. 20, 1921, issue of the *Engineering News-Record* of a paragraph headed, "Wet Aggregates Make Concrete Too Strong," which appeared in an earlier issue, the writer, because of his connection with the original tests and the preparation of the paragraph in question, would offer the following comment.

The writer is familiar with the very extensive and valuable investigations relating to mortars carried on by M. Feret, as well as similar work done by later investigators, and agrees that the fullest credit should be accorded. However, the paragraph referred to was one of many brief statements made monthly describing the studies underway in the concrete laboratory. Without going into detail readily apparent conclusions are briefly mentioned and where evident the relation to field practice is emphasized, but no attempt is made to furnish a full discussion of results or of the work of previous investigators, as is customary in a formal publication. The bulking effect of moist sand is so fully covered in the more recent treatises on concrete that no investigator at this date would imply such information to be a "discovery," nor should any reader familiar with the literature of concrete infer that such an idea were implied. The paragraph as written was based upon tests of concretes as they would be made on the job, and should serve to emphasize to inspectors on concrete work that there may be times when the most rigid specification may properly be modified.

As to the paragraph contradicting the headline the writer cannot agree, although perhaps the word "requires" might have been replaced by the phrase "will result in the use of."

A discussion of Feret's work in connection with cement mortars brings up another point which is worthy of discussion, that is, the improper application, by later investigators and experts, of the results of Feret's work to the production of concrete without verification of the propriety of such application by tests of the resulting concretes. As found by Feret a coarse sand is usually better suited for use in a mortar than a fine sand, which led to the adoption of various specifications for sand limiting the amounts permitted to pass the various sieves. As a result many engineers have been given the wrong impression of the necessary qualities a sand should have, and many first-class sands have been barred from use. As late as a year ago at least one state highway commission still persisted in testing sands in mortars to determine their fitness for use in concretes. Within rather wide limits the fineness of a sand may be increased beyond that grading found to be most desirable in mortar tests, and yet produce concretes of equal or better quality.

It would be interesting to learn Mr. King's authority for his statement that "Wet aggregate . . . requires less cement per cubic yard of concrete . . . because of the consequently less surface area of the aggregate." The writer has found for Potomac River aggregates that the sand may be regraded to have approximately double the surface area per unit volume of the regular run sand, and yet produce a concrete of slightly higher strength when the two concretes have the same amount of cement per cubic yard; also that with concretes of the same cement content a 50-50 sand-gravel ratio produced concrete equal in compressive strength and superior in "working" quality to a concrete in which the sand-gravel ratio was the customary 33-67, the regular run grading being used in both. The square inches of surface area per gram of cement in the 50-50 combination is about 100 per cent more than in the latter.

In view of such test results it is difficult to understand how any controlling relation can be derived for surface area, cement content, and compressive strength within the widest practical working limits.

G. M. WILLIAMS,
Professor of Civil Engineering,
University of Saskatchewan.
Saskatoon, Sask., Jan. 28.

Blighted Chestnut Better Than Healthy Wood

Sir—Edward A. Lambert asks about the propriety of using chestnut-blighted wood, in your Dec. 30 issue, p. 1197. While I have never used chestnut piles I think the facts which I will present show that blighted chestnut would be an improvement over healthy chestnut.

At the outbreak of the blight in New York State the disease was carried into Pennsylvania, near my home, by bales of hay used at the mobilization camp at Mt. Gretna, Pa., during the Spanish-American War. But several years previous it had fallen to my lot to be the first recorded discoverer of the blight in Pennsylvania at a spot in the Pocono Mountains. I seemed to stand alone in my belief that the blight was going to be a calamity when I was asked to speak on the subject at the convention called by Governor Tener of Pennsylvania to consider the blight. The time of the convention was wasted largely in trying to solve the origin of the blight and its habits, and when I got on my feet and advised the body to get busy and find use for the chestnut wood, and predicted that in 15 years there would not be a healthy chestnut tree in Pennsylvania, I felt that my remarks were not taken seriously.

Feeling that probably the circumstances which brought me in contact with trees in my early life gave me a better and clearer knowledge of tree life than was possible to get from books, I believed that some day the question might be raised as to the effect of blight on the life or durability of the product of the blighted trees. Even anticipating this question would come up at the governor's convention, I, in connection with Robert Conklin, then state forestry commissioner, cut from my 500-acre tract of chestnut trees near Mt. Gretna three carloads of chestnut-blighted cord wood and had the wood tested for its tannic acid contents. My prediction that the blighted wood would show up stronger in tannic acid was verified by this test, so we paved the way for at least one source of utilization and were prepared to kill any wild statements that might have influenced the acid men to reject blighted wood.

Anticipating that farmers might refuse to buy chestnut-blighted fence rails and posts we built a blighted fence. We also cut and set up 30 telegraph poles of blighted trees and furnished the Cornwall & Lebanon R.R. Co. with a number of blighted railroad ties. Until the late World War the U. S. Forest Service made annual inspection of the blighted fence, telegraph poles and railroad ties. Their observation, as well as my own, support my theory that the tannic acid in chestnut and oak trees is the preserving element, and the blight by increasing the acid adds to the decay resistance enjoyed by normal chestnut. Some years ago Mr. Nellis, of the Forest Service, sent me a

photograph of a blighted post, showing a blight spot projecting beyond the present surface of the surrounding wood. The unblighted wood had been wasted away by the weather, producing an embossed effect, showing that the blight had made the wood more weather-resisting.

These experiments have helped the farmer, the telegraph companies and the railroads, but this is my first opportunity to present the facts to a brother engineer. I would say to Mr. Lambert that if chestnut has been used for piles in the past use it in the future if the tree has not been dead so long as to suffer from natural decay.

To owners of chestnut groves and telegraph and telephone companies and even farmers I would say: Cut your blighted wood as soon as possible, bark the trees, spray with carbolineum or any other cheap grade of creosote or even gas tar, and put your future supply in storage (off the ground), for there is no wood to take the place of chestnut. It is practically the only universal wood that reproduces itself in one man's lifetime, generally about 40 years from the cut stump. Cutting and regenerating have gone hand in hand in the past, keeping up an even balance. Now the cutting or the dying is taking place not as needed, but as a holocaust.

EDGAR A. WEIMER,
Lebanon, Pa., Jan. 15. Consulting Engineer.

Useful Dodges in Surveying

Sir—It was not my intention when writing paragraph 7 in the article, "Useful Dodges in Surveying," in your issue of Dec. 16, 1920, p. 1164, to revive an ancient controversy between the plane-table and the transit-and-stadia method of topographical surveying.

Lyman E. Bishop, consulting engineer of Denver, Col., wrote an article on "Speed of Topographic Surveys" for the *Engineering Record*, Sept. 19, 1914. Briefly his work averaged as follows, using the transit-and-stadia method: Stadia shots, 473; number of rodmen, 3.8; readings per Rodmen, 126; readings per acre, 0.70.

The acreage covered in 8 hr. was 682 at a total cost of 12c. per acre.

Since writing that article Mr. Bishop has completed several hundred thousand acres of topography and consistently used the transit-and-stadia method in preference to the plane-table. He claims by that method to be able to do better work and to carry it out regardless of weather conditions and at a lower cost than by the use of the standard plane-table. I can agree with Messrs. Hogan and Roberts of the N. Y. Water Power Investigation (see Jan. 6 issue, p. 41 and Jan. 13, p. 88) in regard to the advantage of the plane-table on small scale maps, such as used by the War Department and by the Geological Survey, but must disagree with them in their claims of plane-table superiority under all conditions.

No proper comparisons of the efficiency, speed and cost of the various methods of topographic mapping can be made unless there is a similarity of scale, contour interval, and topography. In the record quoted in my article we used a scale of 400 ft. to the inch and a contour interval of 5 ft. The location of the mapped area was a fairly rough section of irrigable land along the Little Wood River of southern Idaho. The completed maps were so accurate that office locations of all irrigation ditches and other works were made on them prior to construction.

In detail the party and procedure were as follows: The party was composed of a transitman, who was the responsible topographer, a recorder, who acted as assistant topographer and four stadia rodmen armed with 14-ft. self-reading stadia rods. A mule skinner who drove the party to work acted as extra rodman when so required.

A level party had preceded the topographic party and established vertical control by leaving benchmarks on all section corners. The transitman carried his horizontal control with him by careful traverse which was plotted on the field drawing board by latitudes and departures.

The transitman set up his instrument and directed the movements of at least four stadia-rodman. Horizontal angles were read to the nearest 5 min. and vertical angles were read to the nearest 2 min.; the rod was read to the nearest 0.1 ft. The recorder, who was seated near the transit, plotted (with a large semicircular paper protractor which had the map scale marked off along its diameter), the angles the instant they were called out by the transitman; as soon as the transitman could read the rod and vertical angle they were reduced by slide rule and plotted on the map.

In regard to the Beaman stadia arc would say that in my case it would not have been the means of saving any time, since the recorder could always keep up with the transitman and the transitman could not always keep up with the rodmen. Since it takes just as much time to read the Beaman attachment as it does to read the vertical circle there could be no saving in time for the entire party. However, I will admit that the Beaman attachment is a time-saver for the slower plane-table method

Summarizing the advantages of using the drawing board in the field with the transit topographer as compared with the plane-table we have the following:

Control carried accurately in the field; transit steady—does not need frequent level adjustment as in the case with the plane-table; speed of turning transit and locating rodmen is greater; transit stands 2 ft. higher than the plane-table, which has a low visibility; recorder plots just as fast as the stadia shots are read, while with the plane-table the topographer has to stop and scale out and plot the distance after each sighting; paper can be kept cleaner.

In drawing contour lines both the transitman and recorder can work at the same time. The transitman, having directed the rodmen, can delineate the lines expressively, and if enough shots have been taken it makes no difference if the map appears wooden, since if the contour in the field is where it is plotted on the map, that is all that is required. Expressive delineating is only of advantage when protraying geological features on small scale maps or to attempt to mask the inaccuracies of a map plotted with an insufficient number of shots.

I am surprised at the extraordinary relation between scale and contour interval as adopted by Mr. Roberts. The country which can be properly mapped with a scale of 2,000 ft. to the inch and a contour interval of 1 ft. must be as flat as a putting green. The writer is well acquainted with the field scales as adopted by the U. S. Geological Survey. They are as follows: 1:192,000; 1:96,000; 1:48,000; 1:31,680; 1:24,000, and 1:12,000. The contour intervals adopted are 5, 10, 20, 25, 50, 100, 200 and 250 ft. In no case would the Survey use a 1-ft. contour in connection with a scale of 1:24,000, as used on the N. Y. water power investigations. What possible use could be made of a map having a very small vertical error and a very large horizontal error, as there must be on a scale of 2,000 ft. to the inch with a 1-ft. contour interval?

My own rule for topographic scales is as follows: For very mountainous country, such as around the Pike's Peak district, the scale should be ten times the contour interval. For a medium rough country having small buttes, knolls, ravines, pot-holes, and varying in elevation several hundred feet to the mile, the scale should be 100 times the contour interval. For very flat country, such as desert land without any knolls, ravines, etc., the scale should be 1,000 times the contour interval. Moreover, the distance between shots should average a distance in feet equal to the scale of the map in feet per inch.

If we apply the above rule to Mr. Roberts' record it is no wonder that he could map 1,000 acres per day with two rodmen. We Westerners, like the Swiss, rather pride ourselves on our topography, and I for one have no use for the plane-table when a map of serviceable scale is desired.

H. L. THACKWELL,
Denver, Jan. 20. Hydraulic Engineer.

British Transport Institute Growing

According to a recent announcement made by the secretary of the British Institute of Transport, there are now 306 members, 293 associate members, 99 graduates and students, making a total affiliation of 698.

HINTS FOR THE CONTRACTOR

Rock Excavated by Improvised Digger Fixed to Stiff-Leg Derrick

By Paul P. Suiter
Engineer, Ferro Concrete Construction Co., Cincinnati

IN PLACING the foundation in the north half of the new unit for the Baldwin Piano Co. plant in Cincinnati the Ferro Concrete Construction Co., general contractors, found it necessary to excavate approximately 1,100 cu.yd. of rock. The rock consisted of strata of hard blue shale about 2 to 3 ft. thick, separated by 4- to 10-in. layers of blue limestone. The excavation varied for different footings from 5 to 12 ft. in depth.

In the south half of the building dynamite was used for breaking up this rock and under ordinary conditions would have been used in the north half, but because of the interruption to building and danger to traffic on two busy thoroughfares its use was deemed inadvisable. The use of feather and wedges with sledging was of course possible, but was rejected as being too costly.

In order to handle this particular case economically it was necessary to develop special equipment, which the contractor's superintendent on the job accomplished in the following manner: He had on the site a stiff-leg steel derrick equipped with a three-drum engine and 60-ft. boom. To this boom he attached a digger arm, shown in the photograph, which held at its outer end a 12-in. steel pipe about 12 ft. long. The closing line

NOVEL METHOD OF EXCAVATION COSTING LESS THAN DYNAMITING

was fastened to the top of this 12-in. pipe, allowing it to be raised or lowered at will. This pipe acted as a sleeve or guide through which a 2,000-lb. casting with a digging tool on the bottom end was operated by a load line. By raising or lowering the boom and digger arm it was possible to cover an area of approximately 2,200 sq.ft. without moving the derrick.

To operate this equipment required one engineer and two laborers. In excavating, the digger was swung over the footing, and the pipe sleeve lowered and held in position by ropes in the hands of two laborers. The 2,000-lb. weight was raised with the load line and allowed to drop, the force of the blow struck depending, of course, on the distance the weight fell, which in this case varied between 5 and 10 ft. In operating, the crew would dig through the stratum in one footing and then swing around to other footings while the broken rock was being removed. Owing to local conditions which required that all excavation be kept on the site for use as fill in raising the floor level it was impossible to open very many footings at one time. On this account the machine could not be operated steadily more than about one-third of a working day. For this reason also the highest number of footings worked at one time was seven. Requiring only thirty minutes to couple up or remove, the use of the digger did not interfere with the ordinary work of the derrick, the clamshell bucket or logchain being attached and used whenever needed.

The results obtained by the use of this machine were highly gratifying. In one footing 24 x 10 ft. a stratum of hard blue limestone 10 in. thick was completely broken up in thirty minutes, ready for handling without any sledging. The broken rock shown in the photograph gives a good idea of the machine's efficiency in reducing rock to sizes suitable for handling. Besides breaking this rock more thoroughly than dynamite would have done, the time used was less than that necessary for drilling holes for dynamiting. In addition the use of this machine was much safer and did not interfere with work on the job, as blasting would have done. In spite of the fact that conditions, previously explained, permitted the operation of this machine only a portion of each day, although paying the engineer for full time, our costs for breaking up and removing the rock using this equipment were less than one-half the cost of removing the rock in the south half of the building, where dynamite was used. It is believed that by making several changes in the machine, increasing its flexibility, it will be possible to make still further reductions in the cost of rock excavation.

This equipment is shown with a 60-ft. boom, but by using different lengths of digger arms it would be practical to use 80- and 100-ft. booms, which would increase the digging area to approximately 3,700 and 5,900 sq.ft. respectively. Also, by giving the digger arm an adjustment range of 10 ft. in length it would be possible to dig closer to the derrick mast and also operate in deeper holes.

The use of this equipment, moreover, is not limited to rock excavation, for, by using a cap in place of the digging tool, it could be readily adapted to driving wood, precast or sheet piling and similar work. As the cost of driving a small number of piles with regular pile-driving equipment is almost prohibitive, this apparatus, attachable as it is to any derrick, would enable the contractor to handle small piling jobs economically.

NEWS OF THE WEEK

New York, February 17, 1921

Blames Strathmore Collapse on Poor Bond

Vibration Also a Factor in Fall of Nine-Story Apartment, Says Report of R. P. Miller

In a final report on the collapse of the Strathmore apartment house, 52nd St. and Broadway, New York City, Dec. 1, just rendered by the superintendent of buildings of Manhattan Borough, R. P. Miller, to the borough president, the collapse is ascribed to no single definite cause such as overloading, fracture of a structural member, or negligence in conducting the alteration work in progress, but to the generally poor structural state of the old building, shattered condition of the brick work, lack of anchorage of the floor joists, and the possible effects of vibration. "I am of the opinion," says Superintendent Miller, "that the accident was due to a combination of circumstances such as weak masonry construction, lack of anchorages between the floor and wall constructions, unusual and insecure support of the floorbeams on the walls, and other conditions."

East Wall Buckled

As stated in an account of the collapse given in *Engineering News-Record*, Dec. 9, 1920, p. 1155, the conclusion was reached by the chief inspector of the Bureau of Buildings, F. C. Kuehnle, who was on the ground within a few minutes after the collapse, that the east wall of the building failed by outward buckling at about the fourth floor level, possibly due to overloading of floors by material required for reconstruction of the building, then in progress. Superintendent Miller finds, however, that there was not enough material on the floors to cause collapse if all else had been safe. The alteration operations also are not found responsible.

The building, which was erected in 1880 as a nine-story apartment to house sixteen families, is described as being found in unsatisfactory condition. Of the brick work of the walls Mr. Miller says, "When the plastering was removed it was found that the masonry was badly cracked in numerous places. This was especially true in the exterior wall along Broadway where cracks had developed over the arches of nearly all the windows. The brick piers on the interior of the building, it was found, were more or less cracked particularly in about the fifth, sixth and seventh stories, the appearance being that of overloaded brickwork, the overloading being inherent in the construction and not due to any excess load

(Continued on p. 316)

Road Builders Convention Awakens New Interest

Papers of High Technical Value Presented, But Discussion Lags—Contractual Relations a Live Topic—Equipment Exhibit Large and Varied

Renewed interest in the American Road Builders Association was plainly indicated at the annual meeting and exhibition held Feb. 9 to 12 in Chicago. From 100 to 200 members were in regular attendance at the sessions for the reading and discussion of technical papers. This revival of life was the outstanding feature of the meeting. Generally the formal papers and discussions were of high character, though discussion from the floor was lacking. The plan of separate sessions devoted to design and construction, traffic, finance and contractual relations helped to maintain interest. Finally, the exhibition of equipment and materials was varied and excellent and was highly successful in respect to the volume of business transacted.

Technical Meetings

High water mark in interest was reached at the sessions devoted to consideration of subgrade design and research, highway finance and relation between engineers and contractors. The technical facts of chief interest will be reviewed in an early issue of *Engineering News-Record*. Speakers of exceptional importance led the discussion on all the general topics.

Enumerating the failures due to unstable subgrade, H. G. Shirley of the Federal Highway Council, outlined the investigations of subgrade being made and planned. Following him F. H. Eno, Ohio State University, listed the principal problems in road drainage which require investigation and in particular spoke of the moisture studies of clay soils being conducted at the university laboratories. In his discussion of both papers Clifford Older, state highway engineer of Illinois, outlined methods and results of subgrade studies in Illinois covering substantially the information given in his article in this journal, Feb. 3, 1921, p. 210.

Importance was given to the paper on highway finance by the position of its author, H. C. Sylvester, Jr., vice-president of the National City Co., which is virtually the bond department of the National City Bank of New York. Stressing two facts, first, the life term and, second, the investment attractiveness of bonds, the author outlined policies in financing highways as viewed by the banker.

Contractual relations were the subjects of ringing addresses by W. A. Rogers, president, Bates & Rogers Construction Co.; R. G. Collins, Keystone Construction Co., and A. R. Hirst, state highway engineer of Wisconsin. These addresses will be summarized in a later issue. The close agreement of thought by the engineers and contractors who spoke aroused an enthusiasm in discussion which was unequalled at any session of the convention. Here again the virility and forcefulness of the speakers contributed largely to the success of the proceedings.

Business Transacted

Convention business consisted largely of the presentation and discussion of resolutions. Besides formal resolutions of thanks for services rendered, the association placed on record resolutions (1) urging a 25 per cent reduction in railway rates on materials for highway construction; (2) advising producers of materials to get into step with dealers in other commodities in reducing prices; (3) favoring legislation having in view the reduction of automobile accidents on highways; (4) petitioning the United States Senate to pass promptly the Federal-aid House act appropriating $100,000,000 for 1921 highway construction; (5) urging a continuation of Federal aid on the basis of present laws and practices; and (6) urging the removal of state highway departments from political changes, liberal appropriations for developing permanent organizations and an increase in salaries sufficient to secure and retain experienced and qualified engineers in all grades of state highway service.

No formal action was taken in respect to the next place of meeting, but informal comment and particularly the discussions in the lobbies favored a return to Chicago, whose central location and means for accommodating both delegates and exhibits were felt to have contributed largely to the success of this year's convention.

Exhibits and Attendance

Both size and variety characterized the exhibits. To the student in highway research the working exhibits of testing apparatus and processes by the U. S. Bureau of Public Roads was the notably interesting item. Along the same line of educational service were the large exhibits of the various road construction materials associations, the

Board of Local Improvements of Chicago, and the American Association of Engineers. The machinery exhibits embraced an unusual number of large units such as motor trucks, tractors, locomotives, sand and gravel plant equipment, locomotive cranes and large paving mixers.

The attendance was large; it embraced more particularly contractors and subordinate highway officials. Few state highway department engineers were at the convention. Activity in securing a greater attendance of these leaders in carrying out highway improvements will be a task of the directors of the association for the present year.

Federation Chooses Secretary

Lawrence Wilkinson Wallace of Baltimore, president of the Society of Industrial Engineers and member of the American Society of Mechanical Engineers, was unanimously elected secretary of the Federated American Engineering Societies at the meeting of the American Engineering Council at which Herbert Hoover presided, held in Syracuse, N. Y., Feb. 14. A biographical sketch of Mr. Wallace will appear in next week's issue.

To Begin Borings for Tunnel Under Narrows

Request has been made of the War Department by the transit construction commissioner of New York City for permission to make borings in the channel of the Narrows in preparation for the design of a tunnel for rapid transit between Brooklyn and Staten Island. The tunnel projected is to connect with the Fourth Ave. subway in Brooklyn, at either 67th St. or 95th St.

No Prospect of Joining International Road Congress

Upon the initiative of Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, the Secretary of Agriculture some time ago asked the State Department to lay before the President a proposal urging Congress to authorize membership for the United States in the Permanent International Association of Road Congresses. It was hoped that if the President and Congress acted favorably the United States would extend to the association an invitation to hold the next congress, in 1922, in this country.

The State Department has now informed the Secretary of Agriculture that the President does not deem this an opportune time to present to Congress the matter of membership in the association. Accordingly there will be no action during this session of Congress and, the time limit set by the association having expired, it will not be possible for the United States to invite the Congress of 1922 to come here. Accordingly the road congress now automatically goes to Rome, the Italian Government having formally invited the congress, with the proviso that Italy would step aside in case a formal invitation were received from the United States.

Publicity Conference Speakers Are Announced

For the engineering publicity conference which is to be held Feb. 25 at the Congress Hotel, Chicago, under the auspices of the American Association of Engineers the following speakers are announced: Richard H. Waldo, formerly chairman of the publicity committee of the Chamber of Commerce of the United States and now general manager of the Inter-Racial Council; F. M. Feiker, vice-president, McGraw-Hill Co.; Ivy L. Lee, director of publicity for the Interborough Rapid Transit Co., N. Y; C. S. Darling, managing editor, *Factory*; R. W. Crum, chairman, publicity committee, Iowa Engineering Society; J. G. D. Mack, Wisconsin state chief engineer; W. J. H. Strong, president, Lake Breeze Motor Co.

Among the topics for round-table discussions are the following: Engineering news service, technical news service, a national clipping service, news syndicates, publicity possibilities of the technical press, how publicity helps a community, the qualifications of a publicity man, how publicity helps a local society and engineering publicity from the standpoint of the public.

Spirited Bidding Noted in New York Highway Work

In approximately $3,000,000 worth of road contracts awarded last week by the New York State Commission of Highways successful bidders were an average of 12 per cent under the estimates made by the engineer. For the twenty projects advertised there were eighty-three bidders, there being two projects that drew nine bids each, and three projects seven bids. The aggregate cost of the twenty projects was, according to the engineer's estimate, $3,200,291; but that figure has been reduced, through low successful bids submitted, to $2,837,932. The analysis of the bids is given in the accompanying table:

Bid Number	Mileage	Number Bidders	Engineers Estimate	Contract Price	Contract Price Expressed in Per Cent of Estimate	Difference in High and Low Bid
1	3.49	3	$153,789	$149,106	97½	$3,453
2	2.48	7	104,500	89,568	85½	14,138
*3	4.13	9	241,011	219,379	91	21,430
4	2.70	4	121,584	109,684	90	5,940
5	6.98	1	221,723	220,227	99½	.....
6	3.54	4	121,389	111,574	92	4,324
7	3.25	2	110,490	102,844	92½	1,244
8	2.60	5	82,897	73,081	89	6,893
9	3.48	2	123,197	114,434	92½	722
10	3.25	7	118,855	109,694	92½	8,877
11	5.35	9	177,830	153,451	86½	23,959
12	4.09	2	202,314	191,898	94	10,044
13	10.57	3	550,548	525,501	95½	11,725
*14	2.80	3	118,330	108,730	91½	6,550
*15	4.52	2	203,285	196,308	96½	5,127
*16	3.62	2	133,069	131,936	98½	2,113
17	1.38	3	60,070	57,446	95	6,976
18	4.47	4	164,355	156,133	95	11,617
19	1.91	4	147,771	133,571	90½	6,277
*20	0.59	7	43,284	36,818	84	
Totals	75.20	83	3,200,291	2,837,932		
Average	3.76	4+	160,015	141,896	88+	

* Contract not yet awarded—only low bid shown.

Seattle To Vote on Bond Issue

The Seattle city council at a recent meeting voted to submit to the voters at the March 8 election a proposition of issuing bonds in the sum of $750,000 for the construction of the proposed Montlake bridge across the Lake Washington Canal. The council also voted to place before the voters a $200,000 issue for playgrounds and park boulevard repairs. The bonds will bear 6 per cent interest and will be payable in twenty years.

Bridge Bills Before Congress

Bills in Congress extending the time for the construction of bridges over navigable streams include one for a bridge across the Columbia River two miles west of Cascade Locks, Ore., and one for the Castleton, N. Y., bridge of the Hudson River Connecting R.R. Corporation (New York Central R.R. proposed cut-off by-passing Albany and Schenectady). Favorable reports on both bills have been made by the War Department, and the Committee on Interstate and Foreign Commerce has recommended the passage of both bills. In connection with the Castleton bridge, however, a minority report has also been made by the committee supporting the Albany claim that the bridge should provide a 1,100-ft. channel span in order to provide for future improvement of the river to carry ocean traffic to Albany.

Strathmore Building Collapse

(*Continued from p. 315*)

placed on the floors. The brickwork showed little bond." Of the connection between floors and walls he says, "The floor construction was not anchored to the masonry walls, so that there was a looseness between the floors and the walls, which I feel confident was in a large measure a contributing cause of the collapse."

The report describes the support of the heavy and closely spaced joists of the floors (3 x 8 timbers, spaced 3½ in. on centers in a large part of the building) at the walls as being accomplished by resting the beams on corbel courses of the brickwork, the beams entering only a short distance into the wall masonry and having no connection to the walls by metal anchors. It then continues "With the loose construction of the building and the condition of the building due to the shoring and work of alteration it seems natural to suppose that vibration of some kind in the structure started the collapse. Investigation, however, has failed to find any evidence of a disturbance of that kind at the time of the collapse." Supplementing the written report Mr. Miller states that street traffic is the most probable source of vibration acting to disintegrate the loose structure of the building, and that progressive separation of floor and wall at the insecure corbel connections probably occurred.

The New Administration of the Am. Soc. C. E.

In this and succeeding issues of Engineering News-Record *will appear brief biographical sketches of the newly elected officers and directors of the American Society of Civil Engineers, as announced in the issue of Jan. 20, p 140, following the annual meeting.*

Edward E. Wall, Vice-President

Edward E. Wall, vice-president, has served since 1911 as water commissioner of St. Louis, Mo. He was born in Saline County, Mo., Aug. 15, 1860, and was graduated from Missouri State University in 1884 with the degree of C. E.

He engaged in railroad surveys and construction in Missouri, Kansas, and Nebraska from 1884 to 1888 and became U. S. assistant engineer on secondary triangulation of the Upper Missouri River in 1889. In 1890 he entered private practice in St. Louis, and two years later joined the St. Louis Water Department as assistant engineer. He was promoted to first assist-

EDWARD E. WALL

ant engineer of the St. Louis Sewer Department in 1895 and had charge of all construction and reconstruction of sewers, directing a large portion of the designing. Here he served until 1903, when he was named principal assistant engineer of the St. Louis Water Department.

In 1906 he was promoted to become assistant water commissioner, designing and directing reconstruction of settling basins and conduits, and installing machinery and apparatus necessary to put in operation a scheme of clarifying and purifying the Mississippi River water by coagulation and simple sedimentation. During this period Mr. Wall designed and built additional basins, conduits, and other facilities for increasing the capacity of the water-works.

In 1911 he was appointed water commissioner, a position which he still holds. He made an exhaustive report to the Board of Public Improvements on the water supply of St. Louis in 1912, recommending a comprehensive plan for enlarging and increasing the capacity of the existing water-works to a capacity sufficient to supply the city until 1926, and outlining a plan for new water-works to be located on the Missouri River.

His recommendation for enlarging the existing works has been carried out substantially as planned. It included the construction of the Chain of Rocks filters, with a rated daily capacity of 160,000,000 gal., the largest rapid-sand filter plant in the world.

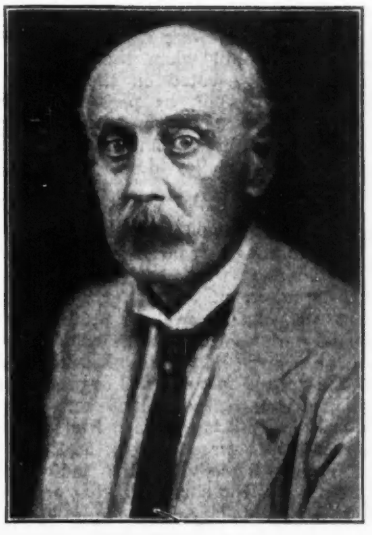
The plan for new works on the Missouri River was closely studied and worked out in considerable detail before being presented to the Board of Public Service in 1915. A committee of the Engineers' Club approved the scheme and steps are now under way to purchase the necessary land for the new plant.

Mr. Wall is a past-president of the Engineers' Club of St. Louis, a member of the American Water-Works Association, the American Public Health Association and the New England Water-Works Association. He was awarded the Thomas Fitch Rowland prize by the American Society of Civil Engineers in 1908, was a member of the nominating committee in 1911-12, and director from District 9 in 1918-20.

Andrew M. Hunt, Vice-President

Andrew M. Hunt, vice-president, has long been identified with a variety of engineering work, much of it on the Pacific Coast, and is now a consulting engineer with offices in New York City. He was born in Sioux City, Iowa, in 1859, and was graduated from the U. S. Naval Academy in 1879. Until 1894 he served in the Engineer Corps of the Navy, when he resigned to enter private practice in San Francisco as a member of the firm of Hasson & Hunt. While a member of this firm he was identified with many important hydro-electric projects on the Pacific Coast. In 1898 and 1899 he went to Alaska and built four steamers for the Alaska Commercial Cable Co. for service on the Yukon River. He returned to San Francisco in 1899 and until 1904 engaged in private practice, specializing in the development of hydro-electric power. In 1905 the firm of Dillman & Hunt, consulting engineers, was established in San Francisco.

In 1915 Mr. Hunt moved to New York City and became president of the Peyton-Hunt Co., consulting engineers. He served during the war as a member of the Naval Consulting Board and on the ship protection committee of the U. S. Shipping Board. During the period of the Panama-Pacific Exposition at San Francisco Mr. Hunt served as chief of the department of machinery. Among other recent projects upon which he has been called into con-



ANDREW M. HUNT

sultation is the Hetch Hetchy water project for San Francisco. Prior to his election to the vice-presidency of the society Mr. Hunt served on the Board of Direction.

Civil Engineers Discuss Heat, Light and Power

Continuing its series of meetings devoted to the consideration of the outstanding engineering problems affecting the metropolitan district of New York, the New York Section of the American Society of Civil Engineers devoted its meeting of Feb. 9 to the subject of heat, light and power. Members of the local sections of the mechanical, electrical and mining engineering societies were invited by the civil engineers to attend the meeting.

The opening address was by Col. William Barclay Parsons, consulting engineer, New York City, who discussed the power needs of the metropolitan district, dealing specifically with central station development, New York State's potential resources in water power and the possibility of generating power in stations at coal mines.

Ten-minute discussions were presented by the following engineers: J. W. Lieb, vice-president, New York Edison Co.; Frank Smith, vice-president, United Electric Light & Power Co.; Farley Osgood, vice-president, Public Service Electric Co. of Newark, N. J.; George Otis Smith, directtor, U. S. Geological Survey; H. E. Skougor, consulting engineer, New York; George Gibbs, consulting engineer, New York; William Cullen Morris, engineer of construction, Consolidated Gas Co.; F. O. Blackwell, consulting engineer, New York; and W. S. Murray, chairman, Super-power Survey.

House Passes Federal-Aid Road Bill

Sells' Measure Authorizes $100,000,000 for Next Fiscal Year—Only 58 Opposing Votes

Only 58 votes were cast against the Sells' roads bill when the House of Representative voted on the measure Feb. 7. The bill, as passed by the House, provides an appropriation of $100,000,000 for continuing the federal-aid road policy during the next fiscal year.

The opposition to the bill was led by Representative Dunn, of New York, chairman of the committee on roads. He contended that the present financial situation of the country is such that the expenditure of $100,000,000 should not be authorized when there still is a large balance in the Treasury of federal-aid money. He argued that $117,000,000 of the balance of $200,000,000 has not been allotted under the agreements between the U. S. Bureau of Public Roads and the individual states. Mr. Dunn reasons that with a $200,000,000 balance plus the 135 per cent which the states must appropriate there is some $500,000,000 available for future construction—more than could be accomplished in ten years.

Mr. Sells submitted statistics, however, showing that ten of the forty-eight states already have contracted for the expenditure of their entire allotment, and that at the present rate of progress thirteen additional states will be without funds for new contracts at the close of the current fiscal year. Only eight states, he said, will have an unallotted balance to their credit at the close of the calendar year. He declared it to be unfair to say that there is an unallotted balance of $117,000 000.

Grand Trunk Arbiters Bar Costs of Reproduction Value

The Grand Trunk Arbitration Commission by a vote of 2 to 1 Feb. 7 decided against the admission of evidence of physical value and cost of reproduction in the settlement of the controversy of reparation to stockholders. Hon. William Howard Taft dissented from the opinion which was supported by the other two commissioners, Sir Walter Cassels and Sir Thomas White.

Tie Producers Adopt Standards

The National Association of Railroad Tie Producers at the third annual convention, Jan. 27 28 at San Francisco, adopted standard specifications for railway cross ties understood to be practically identical with those to be recommended at the annual convention in March of the American Railway Engineering Association by its tie committee. The producers' specifications cover material, physical requirements, design, manufacture, inspection, delivery and treatment.

American Specification Institute Plans Maturing

A new organization, the American Specification Institute, has been launched in a tentative way by a small group of architects and engineers. These men feel that there is a lack of means for collecting and distributing information concerning specifications and their preparation. That the specifications are now the product of individual effort and as such vary in many features that can be conventionalized thus eliminating a needless duplication of study, research and labor on the part of specification writers.

The plan and scope of the organization which will hold an organization meeting early in March is as follows:

To increase knowledge concerning and improve the methods of writing specifications. The kinds of specifications included are those for buildings, engineering structures and all works whatsoever in which materials of construction and labor are used; for the installation and use of mechanical and sanitary apparatus and equipment; for the fabrication and installation of all furnishings and furniture; for all ornaments and ornamentation, both interior and exterior; for paving, planting, embellishing and improving of grounds and waterways; and for such other things as are produced or sold on specifications.

The Institute is intended not to interfere with any of the present organizations such as the American Society for Testing Materials, kindred national and local architectural and engineering societies, manufacturers and trade associations, but will endeavor to carry forward the activities of such and give additional assistance to specification writers. Membership will be composed of active members, persons who devote their entire time or a part to the writing of specifications; associate members, persons who employ specification writers; and honorary members, testing and laboratory engineers and instructors in specifications writing in architectural and engineering schools.

SCOPE OF WORK

The work of organization will consist of (1) study of materials and (2) methods of writing specifications. Items under the first subject will be the production and physical properties of raw materials; methods of manufacturing, fabrication and finishing; relative value based on appearance, initial cost and maintenance, effect of combinations with other materials and proper materials for various types of buildings of varying grades.

Under (2) a study will be made of the means of accomplishing complete co-operation between the drawings and specifications and determining what methods of construction and installation should be used, what the drawings should show or indicate and what should be omitted for inclusion in the specifications; the development of an outline or checking list; the general contract conditions; specific requirements governed by local conditions; use of standard specifications of materials as prepared by societies and manufacturers; the arrangement of specifications so as to conform to the sequence of construction and installation of the work; the writing of specifications that are clear, concise, coherent and that can be understood by the courts; the principles of contract law as it affects the writing of specifications.

More Specifications Submitted to Standards Association

According to recent announcement of the Engineering Standards Committee, the National Electrical Code of the National Board of Fire Underwriters, 1920 edition, as well as three specifications of the American Society for Testing Materials, have been submitted to the committee for approval as tentative American standards. The three specifications cover a test for toughness of rock, a method for distillation of bituminous material suitable for road treatment, and a method for sampling coal.

New Standardization Work

At a conference held in New York, Feb. 2, under the auspices of the Engineering Standards Committee to consider the standardization of insulated wires and cables, the conclusion was reached that unification of specifications for wires and cables (for other than telephone or telegraph use) should be undertaken as a single general project. The work under discussion relates to quality, stranding and sizes of the conductor; rubber insulation; varnished cloth insulation; impregnated paper insulation; enamel, cotton and silk covered magnet wire; asbestos and other fibrous coverings; sheath and armor; and standard make-ups.

Revised specifications for Portland cement, agreed upon by Committee C-1 of the American Society for Testing Materials and the government interdepartmental committee on cement, have received the approval of the American Engineering Standards Committee.

States Want Army to Turn Over Road Equipment

Representative C. Frank Reavis, of Nebraska, announced last week that he will endeavor to have his bill, which directs the Secretary of War to turn over to the forty-eight States automobiles, tractors and mobile shop units needed for the construction of highways, attached to the army appropriation bill in the Senate.

The appropriation bill passed the House Feb. 9 with a rider attached by Representative Anthony, of Kansas, directing that the machines should be sold on the open market. The Anthony rider was subject to a point of order in the House, but as no point of order was taken, an amendment to the rider is now in order in the Senate.

In the meantime, telegrams and letters are pouring in on Congress from highway officials in every State from Maine to California, demanding that the machines be made available to the states at once so that construction of highways need suffer no further delay.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Annual Convention, Houston, Texas, April 27.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago; Convention, March 15-17.

The Arkansas Engineering Society, at its annual meeting Jan. 17, voted to become a chapter of the American Association of Engineers. An engineers' license bill has been prepared for submission to the state legislature at this session.

The Portland (Ore.) Section, Am. Soc. C. E., at its annual dinner Jan. 14, elected the following officers: President, M. E. Reed; first vice-president, Samuel Murray; second vice-president, Ben S. Morrow; secretary, C. P. Keyser and treasurer, Charles J. McGonigle.

The Colorado Society of Engineers at its annual meeting Jan. 19, elected the following officers: President, F. C. Dreher; vice-president, R. M. Hosea; secretary, C. M. Lightburn. Three addresses were given as follows: "Engineers Problem of the West" by Fred J. Lucas; "Transportation" by John Crook and "Engineers' Liscense Law" by Senator Walter O'Brien.

The Engineers' Club of the Youngstown (Ohio) District at its December meeting elected the following officers: President, C. S. Robinson, vice-president and general manager, the Youngstown Sheet & Tube Co.; vice-president, W. C. Coryell, consulting engineer, the General Fireproofing Co.; directors, two year term, E. F. Vogel, Mark Pendleton, Howard Bishop; trustees, two year term of office F. E. Kling and E. T. McCleary.

The Washington Irrigation Institute at its two-day session held recently in Spokane elected the following officers: President, R. K. Tiffany; first vice-president, William O'Brien; second vice-president, J. L. Keller.

The Southern California Section, Am. Soc. C. E., at its annual meeting in December elected the following officers for the year 1921: President, H. W. Dennis, chief engineer of construction, Southern California Edison Co.; first vice-president, R. J. Reed, chief engineer, Union Oil Co.; treasurer, E. R. Bowen, consulting engineer; secretary, F. G. Dessery, consulting engineer.

A Buffalo Section, Am. Soc. C. E. was organized Jan. 25. The following officers were elected: President, A. L. Johnson; vice-president, George B. Bassett; secretary-treasurer, Bruce L. Cushing. The annual meeting will be held April 5.

The Spokane (Wash.) Section, Am. Soc. C. E., at its recent annual election, named E. G. Taber, president and Charles E. Davis, secretary-treasurer.

The Associated Engineers of Spokane, at the annual meeting Jan. 21, elected the following officers: President D. F. Henderson; secretary-treasurer, A. D. Butler.

The Providence (R. I.) Engineering Society, at its fifth annual banquet, Feb. 1 was addressed by Prof. William J. Cunningham on "Federal Control of Railroads." This subject was discussed also by Arthur P. Russell, vice-president of the New York, New Haven & Hartford R.R.

The Jamestown (N. Y.) Engineering Society was organized at a recent meeting with the following officers: President, Walter F. Shaw; vice-president, E. C. Dollard; secretary, H. G. Garlock; treasurer, F. A. Irvine.

The United Engineering Society, New York, at its annual meeting Jan. 27, elected the following officers: President, J. Vipond Davies; first vice-president, Calvert Townley; second vice-president, W. L. Saunders; secretary, Alfred D. Flinn; treasurer, Joseph Struthers; assistant treasurer, George H. Pegram.

The Webster City Engineers Club, Webster City, Ia., has been organized as one of the sectional clubs of the Iowa Engineering Society. At its first regular meeting Jan. 29 it was decided to take an active part in all local affairs and not confine itself to engineering activities.

The Iowa Engineering Society directors have elected Lloyd A. Canfield, Des Moines, secretary-treasurer to succeed John H. Dunlap who was named president at the annual meeting Jan. 20.

The Rochester (N. Y.) Engineering Society announces the following meetings: Feb. 18, special meeting, a four reel moving picture on the manufacture of leather belting provided by the Charles A. Schieren Co. of New York; March 11, "Power Development of Niagara Falls" by John L. Harper; April 8, "Industrial Electric Heating" by C. F. Hirshfeld; Feb. 23 luncheon, "The Arguments for the St. Lawrence Waterway" by C. P. Craig.

The Topeka Engineers Club, at its annual meeting Jan. 31, elected the following officers: President, M. W. Watson; first vice-president, A. B. Griggs; second vice-president, F. W. Epps; secretary, P. J. Carter; treasurer, Roy Finney.

The Detroit Engineering Society, at its Feb. 18 meeting, will be addressed by L. P. Alford, on "The Engineer in Industrial Reconstruction."

PERSONAL NOTES

J. T. CARROLL has organized the Carroll Contracting Co., New York.

CHARLES B. HAWLEY, for seven years assistant hydraulic engineer, Aluminum Co. of America, has entered private engineering practice with offices in the Munsey Building, Washington, D. C. He will specialize in hydro-electric development and steam power plants. During his connection with the above firm he had charge of the design of several of the largest water power developments in this country. He has also made extensive hydraulic investigations abroad.

C. B. SMITH, editor of the *Professional Engineer*, official organ of the American Association of Engineers, has accepted a position with the Chicago Bridge & Iron Works as publicity man and editor of the *Water Tower*.

HOLBROOK, WARREN & ANDREW have purchased the business of Miller, Holbrook, Warren & Co., Decatur, Ill., and will continue the structural and municipal engineering business organized by the latter company. Frank D. Holbrook and Capt. Clarence R. Andrew were formerly with the Government on Ohio River improvements and Willis D. P. Warren has been ingaged in engineering work, principally municipal projects, in Illinois for seventeen years.

F. P. JOYCE and S. J. WILLIAMS, formerly in the county engineer's office, Indianapolis, Ind., have opened an office as consulting engineers in Indianapolis.

W. T. HOGG, for three years connected with the engineering department of the Dock Board at New Orleans, La., has been appointed chief draftsman.

R. C. MARSHALL, JR., former head of the Construction Division, U. S. A., was nominated on Feb. 10 to be brigadier general in the Reserve Corps. Gen. Marshall is now actively engaged as the general manager of the Associated General Contractors.

CAPT. W. J. WILSON has been appointed to the newly created office of assistant chief engineer in the engineering department, Port Commission, Seattle, Wash. George F. Nicholson is chief engineer.

ALEXANDER MURDOCK, chief adjuster, U. S. Emergency Fleet Corporation, has been appointed city engineer of Chicago. He ranked first in a recent civil service examination for the position held for more than a year under temporary appointment by P. S. Combs. Mr. Combs ranked second in the examination. Mr. Murdock was graduated from the University of Pennsylvania in 1882. His early experience includes tunnel construction on the Wilkesbarre & Scranton R.R. Co. and

for the Stricker Water Tunnel Co., Colorado Springs. For three years he was assistant city engineer of Reading, Pa., and from 1900 to 1903 was city engineer. From 1905 to 1918 he was connected with surety companies and bonding contractors. In the latter year he became vice chairman, later chairman of the claims board of the Emergency Fleet Corporation.

C. B. FREEMAN, recently chief engineer of the Walter S. Newhall Co., Cleveland, Ohio, is now actively interested in the contracting firm of Lane & Freeman, incorporated last summer to engage in the construction of bridges, industrial buildings and heavy concrete structures with offices in St. Louis and Cleveland.

BURR H. SIMPSON, for several years field engineer with the Portland Cement Association, has resigned to become sales engineer with the Kentucky Rock Asphalt Co., Louisville, Ky., with headquarters at Buckhannon, W. Va.

R. F. MCDOWELL, of the Cleveland division of Morris Knowles, Inc., and formerly principal assistant engineer to R. Winthrop Pratt, has been appointed county engineer of Cuyahoga County, Ohio. He will retain his position as division engineer in the Knowles organization, but will give most of his time for the next few months to organizing the new department, created to design and construct water and sewer systems for Districts 1 and 2, upon which a preliminary report was submitted by MacDowell & Garvin in June, 1920.

LOY E. SNEARY, formerly principal assistant engineer of Davenport, Ia., has been appointed city engineer of East Moline, Ill.

WILLIAM J. SHEA, formerly Major of Engineers, U. S. A., in charge of the procurement, storage and issue branch, Office of the Chief of Engineers, Washington, D. C., received his discharge Jan. 1 and has been appointed construction engineer, Department of Public Works, Bureau of Highways, Brooklyn, N. Y.

C. DEL VALLE ZENO has resigned his position as manager and chief engineer for Riera, Toro & Von Twistern, New York, to open a consulting engineering office in Havana. He will also establish a New York office in the near future.

MAJOR CLYDE V. TAYLOR, late of the Corps of Engineers, U. S. A., who has been with the U. S. Indian Irrigation Service for several years, both before and since the war, has resigned from that service and will be associated with his brother, L. H. Taylor, consulting engineer, at Reno, Nev.

THOMAS L. WILKINSON, for ten years in charge of the operating department of the Intermountain Railway, Light & Power Co., has retired from that department to resume his consulting work. He will specialize in the design and construction of power and industrial plants, investigation, operation and reports on public utilities, appraisals and valuations. His office will be in Denver.

COL. FREDERICK STUART GREENE, formerly New York State Highway Commissioner, announces that he has opened an office in New York City as consulting engineer on highway construction, highway department organization, waterproofing, pier, dock and concrete construction.

L. C. HERRICK, of Norwalk, Ohio, has been appointed State Highway Commissioner of Ohio, to succeed A. R. Taylor. The new commissioner has served three terms as engineer of Huron County, Ohio. He has also served as city engineer of Norwalk, assistant engineer of Mansfield, and for three years as assistant engineer in the maintenance of way department of the Big Four.

ALFRED J. CLEARY, chief assistant engineer of San Francisco, has resigned to enter private practice as consulting engineer in that city. He has opened an office in the Mills Building and will undertake general construction work with special attention to the hydroelectric field. Mr. Cleary entered the employ of the city engineering department twelve years ago as an inspector and worked up through various grades. During the years in which the Hetch Hetchy project has been under construction Mr. Cleary has been in entire charge of that work, reporting to M. M. O'Shaughnessy, city engineer.

G. LEWIS TAYLOR, assistant chief engineer of the McClintic-Marshall Co., Pittsburgh, Pa., has been appointed chief engineer of that company, succeeding the late Paul L. Wolfel. Mr. Taylor who held the position of assistant chief engineer for the past twelve years, was graduated from the University of Pennsylvania in 1900. His connection with the McClintic-Marshall Co. dates from a period shrortly after the inception of that company, and his experience includes a prominent part in the construction of most of the great bridges and other structures erected by the company.

NELSON A. ECKART has been appointed chief assistant city engineer of San Francisco, succeeding Mr. Cleary. Mr. Eckart has been in the employ of the city engineering department about seven years. For some time he was in charge of design and construction on the municipal railway and in recent years has been construction engineer on the Hetch Hetchy project with headquarters at Groveland, Cal.

LOUIS C. BOONE, of Rowesville, S. C., has been appointed engineer of Orangeburg County, S. C.

T. OWENS has been appointed city engineer of Port Angeles, Wash.

OBITUARY

EDWARD C. BARNARD, commissioner of the International Boundary Commission, which is engaged in defining and marking the boundary between the United States and Canada, except on the Great Lakes and the St. Lawrence River, died in Washington, Feb. 6. He was born in New York City, 1863, and was graduated from Columbia University School of Mines in 1884. In that year he joined the U. S. Geological Survey as topographer and geographer and since 1887 has had independent charge of this work. He took a prominent part in the map making work of the survey and mapped sections of Virginia, Tennessee, Kentucky, New York, Washington, Montana, Oregon and California, also sections of Alaska. In 1901 he was detailed by the Secretary of the Interior to examine and make report on the Northwest Boundary line between the United States and Canada and, in 1915, he was appointed commissioner to represent the United States in the establishment of the boundary with Canada.

EDWARD C. BARNARD

JAMES F. FISHER, former engineer of Williamsport, Pa., died Feb. 5 at Muncie, Ind. He was born at Wapakoneta, Ohio, in 1866 and was a graduate from Ohio State University. He served as city engineer of Williamsport from 1903 to 1909. At the time of his death he was practising in Indiana.

FREDERICK W. SHEPPERD, founder and for thirty-three years proprietor of the journal that subsequently was named *Fire and Water Engineering*, died at his home in Brooklyn, N. Y., Feb. 8. For a brief period in 1886 Mr. Shepperd was employed on the business staff of *Engineering News*.

Seattle Announces 20 Per Cent Wage Cut

After various conferences between the executive committee of the Seattle Master Builders Association and representatives of the employees, an agreement has been reached whereby the wages of all men employed in building trades have been decreased 20 per cent, a new wage scale becoming effective Feb. 1. The reduction furnishes the basis of the minimum wage for 1921, the contractors being pledged not to reduce wages further this year. The reduction has been made in the hope of stimulating building construction.

Railway Labor Board Opposes Wage Cuts

In a decision rendered in Chicago, Feb. 10, the Railway Labor Board, denied the plea of the carriers for immediate abrogation of national working agreements and for setting aside of basic wage rates for common labor, substituting prevailing local rates of wages. Following the decision the executives announced that the roads would now proceed individually to request conferences with unskilled employees on wage reductions to bring the cases before the Labor Board in the form of definite controversies between men and management.

The Railway Labor Board, in its decision, took the position that it could not render a decision abrogating existing contracts, although made during the period of federal control, without further hearings of the case. As to the financial dilemma of the railroads the chairman of the Labor Board declared this to be within the jurisdiction of the Interstate Commerce Commission.

Wisconsin Proposes Law Providing Unemployment Insurance

A bill to compel employers to pay an insurance benefit to their workers, when unemployed, has been introduced into the Wisconsin Legislature by Prof. John R. Commons of the department of economics of the University of Wisconsin. The proposed bill would require employers to form mutual insurance companies and pay benefits to the workers they discharged at the rate of $1.50 per day for adults and 75 cents a day for boys and girls between the ages of sixteen and eighteen years.

Benefits would be obtainable by employees provided they had worked at least twenty-six weeks, on the basis of one week's benefit for every four employed. Workers idle as a result of strikes or lockouts would not be entitled to benefits, nor would farm labor. The author of the bill asserts that the fear of unemployment is the greatest deterrent to the amicable adjustment of industrial relations. He also asserts that such a bill would have the effect of making employment continuous in any industry, the employer avoiding slack time through fear of penalties.

Prevailing Rate of Wages Ordinance Repealed at St. Louis

After a half year of contention at St. Louis, Mo., over payment of the "prevailing rate of wages" on all city work, the board of aldermen has repealed its ordinance on the subject, generally known as Board Bill No. 28, that has held up city construction work for some months past. The ordinance was passed in June, 1920, and provided, among other things, that on all work done by the city of St. Louis, either through direct forces or by contract, there should be paid the prevailing rate of wages, which was the rate established by the city in its own maintenance operations, and which had been uniform with the trade-union scale for similar services.

After the passage of the bill the city of St. Louis in advertising bids on several contracts discovered that in each instance the contractors failed to bid, inasmuch as they would be forced to pay a fixed rate which was slightly in excess of the open market. The situation was taken in hand by the board of public service in November, 1920, which body recommended the repeal of the labor ordinance to the board of aldermen, indicating that it would be impossible for the city to secure bids on either sewerage or paving jobs to be paid for by special tax as long as the ordinance remained in effect.

After various conferences in which both the general contractors and the labor unions took active part, the ordinance was repealed. Repeal becomes effective in March.

Wanaque Contract Review Refused

A writ of certiorari to review an award by the North Jersey District Water Supply Board for a dam on the Wanaque watershed to W. H. Gahagan, Inc., of Brooklyn, has been denied by Justice Gummere of the Supreme Court of New Jersey. The application for a writ was made in the name of the Rollin Construction Corp., New York, an unsuccessful bidder, and Andrew H. Scott, a taxpayer.

The argument for the application of a writ was based upon the contention that the advertisement contained the words "to the lowest, best qualified bidder," whereas the law requires the wording to be "to the lowest responsible bidder." The Rollin people contended that the manner in which the advertisement was prepared gave too much authority to the commission to determine the comparative competence of bidders.

The Rollin Construction Corp. submitted the lowest bid, being approximately $8,000 below the engineer's estimate and the bid of the successful contractor. As explained in *Engineering News-Record*, Nov. 18, p. 1013, the successful bidder, W. H. Gahagan, Inc., bid on a cost-plus basis, whereas the Rollin corporation bid on a straight unit-price basis.

Cement Production 100,000,000 Barrels in 1920

According to estimates prepared under the supervision of Ernest S. Burchard of the United States Geological Survey, the production of portland cement within the United States in the year 1920 amounted to 100,302,000 bbl. and the shipments to 96,329,000 bbl. Compared with 1919 this figure represents an increase of 24 per cent in production and 13 per cent in shipment. The average factory price in bulk at the mills for the whole country was $2.01 a barrel in 1920 as compared with $1.71 in 1919, an increase of 17.5 per cent. The statistics compiled by Mr. Burchard include reports from practically every manufacturer of portland cement and are based upon records for the first eleven months, plus estimates for December.

Marine Equipment Manufacturers Organize

Representatives of forty-five marine equipment manufacturers recently met in New York City to form the Marine Equipment Manufacturers Association, an organization designed to promote good will between those who buy and those who sell marine equipment and supplies; to promote and supervise exhibits; and to co-operate with other associations in the marine field to the end that their efforts in the advancement of the designing, building and operation of ships shall be most productive. It is planned to have the manufacturers association closely resemble the Railway Supply Manufacturers Association, serving the marine field as does the latter organization serve the steam railway field. The temporary officers of the new association are: Acting president, Edward A. Simmons, *Marine Engineering*, and acting secretary, K. L. Ames, Jr., American Steel Foundries.

Alpha and Cement Securities Plan Consolidation

A committee composed of the large stockholders of the Alpha Portland Cement Co., Easton, Pa., and the Cement Securities Co., Denver, Colo., have prepared a plan for the consolidation or merger of these two companies, and have recommended its adoption to the other stockholders of the two companies. The Alpha Portland Cement Co. has cement mills in New York, New Jersey, Pennsylvania, West Virginia, Ohio, Michigan and Illinois, with executive offices at Easton, Pa., and Chicago, Ill. The Cement Securities Co. controls mills operating in Colorado-Utah, Montana, Nebraska and Oklahoma.

If the stockholders of the two companies approve the plan of consolidation, the new company will be one of the largest manufacturers of portland cement in the United States, having an annual capacity well in excess of 12,000,000 bbl.

To Bid on Pennsylvania Roads

Pennsylvania will receive bids Feb. 18 on 104 miles of highways, mostly of reinforced concrete. This mileage is divided among twenty-one projects.

Ohio to Let Road Contracts

Highway and bridge improvement contracts involving estimated construction costs of close to $1,500,000 are announced by L. C. Herrick, State Commisssioner of Highways of Ohio. Bids will be opened Feb. 25 at Columbus. There are nine federal-aid projects and seven other sections of highway on the program. Among the types of surfacing called for are bituminous macadam, waterbound macadam, bitulithic, brick, plain and reinforced concrete and Kentucky rock asphalt.

Nominating Committee of Building Congress Named

The nomination committee of the New York section of the National Congress of the Building and Construction Industry, provided for in a resolution passed at the recent preliminary organization of the New York section, as noted in *Engineering News-Record*, Feb. 3, p. 239, has been named by the chairman. The members of the nominating committee, whose duties will include the selection of an organizing committee to perfect the New York district organization, making it a permanent body, is composed of the following: Electus D. Litchfield, architect; F. M. Feiker, managing editor McGraw-Hill publications; Ronald Taylor, sub contractor; John Lowry, Jr., general contractor; Andrew J. Post, steel contractor, and Alexander M. Bing, investing builder.

New England Road Builders Form Organization

At a meeting of Massachusetts highway contractors in Boston Jan. 18 a permanent organization, under the name of the New England Road Builders' Association, was formed. The objects of the organization are to protect and promote the interests of highway contractors and to establish better relations with public officials.

The officers of the association are: Ransom Rowe, president; John F. Coleman, vice-president; Joseph A. Tomasello, treasurer, and Frederick Hoitt, secretary.

Relief for Contractors Operating Under Supervising Architect

Contractors who failed to submit their claims in time to take advantage of the act of Aug. 25, 1919, relieving them from losses caused by war conditions practically have been assured of reimbursement by the action of the House committee on public buildings and grounds in recently reporting favorable legislation to that effect. The legislation applies only to those contractors who are engaged in the construction of post offices and other buildings under the supervising architect.

Foreign Building Materials Appear in Local Markets

Persons representing themselves as European brick manufacturers' representatives have been in the New York market offering foreign made brick in competition with American made products at a delivered (dock) price below that of domestic brick at wholesale. Belgian steel and glass have also been offered at prices which are considerably below the levels governing domestic products of this sort. The latest and what is considered by the Dow service daily building reports as the most aggressive foreign building material sales drive, is that centered around German cement. Norwegian lumber has also been offered in competition with Douglas fir from the Pacific Coast. Shipping interests have found it more or less convenient to return from European ports with such cargoes as building materials, inasmuch as the falling rates of exchange have made it rather difficult for bottoms to return with anything in their holds but sand and gravel.

Knight Law Held Unconstitutional

A decision handed down Feb. 2 by the Court of Claims of New York declares unconstitutional the Knight law, designed to reimburse those highway contractors who incurred losses because of the increased cost of labor and material during the war. Claims which were filed with the Court of Claims under the provisions of the act totaled almost $5,000,000. The law was passed in 1919 when $3,000,000 was appropriated to meet these claims. Last year an additional $4,000,000 was appropriated. The prevailing opinions, written by Judges Moreschauser and Ackerman, were handed down in the case of the Dale Engineering Co., which sought to recover $27,405. In holding the act unconstitutional the Court of Claims declares that it is imperfect in that it allowed extra compensation to a contractor and further violates the constitution in that it audits and allows private claims against the state.

Employers Commend Efficiency of Journeymen Bricklayers

Believing that injustice had been done the journeymen bricklayers in the frequent publication of articles calling attention to the general inefficency of labor the Mason Contractors Association of the United States and Canada, in its recent annual convention in Detroit, came to the defense of the bricklayers. In resolutions passed at the convention the mason contractors expressed the conviction that, except in isolated cases, journeymen bricklayers were now producing an amount of work that compares favorably with that of pre-war years, and that they were cooperating with the mason contractors in endeavoring to give the public the best of service.

Contracts Awarded on 57 Per Cent of Permits Issued

According to an investigation made by the Southern Pine Association permits were issued during 1920 for all classes of buildings for a total value of $4,527,245,933, whereas actual construction was undertaken upon permits granted amounting to only $2,564,582,000. Of the contracts awarded upon these permits during 1920, 22 per cent was for residence construction.

Southern Lumber Exporters Ask Standard Contract Form

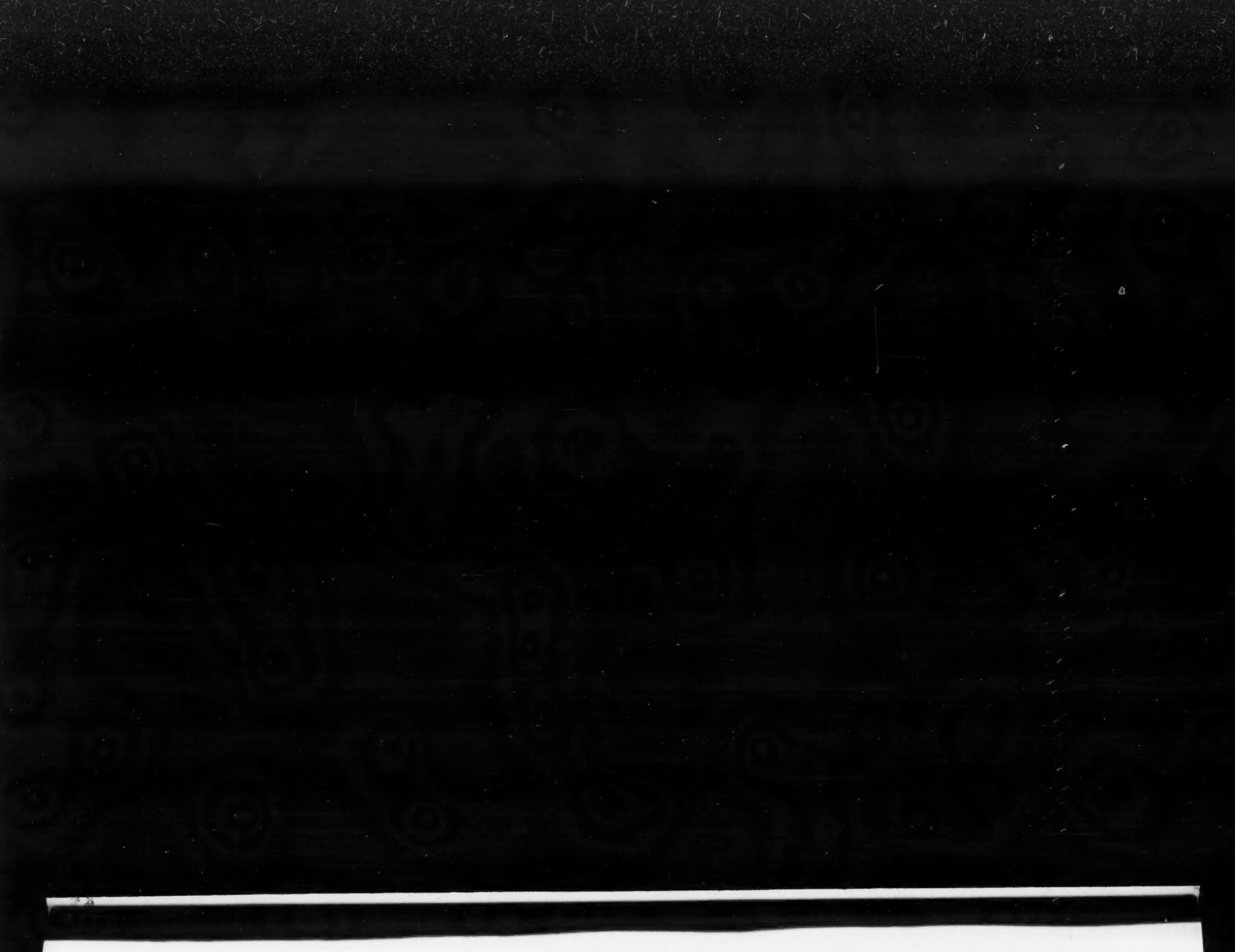
In order to avoid the further cancellation of export contracts which have caused serious losses to Southern exporters since the war, a committee of the Southern Lumber Export Association has been appointed to draft a standard form of contract. The form of contract, which it is hoped will improve the lumber export business from New Orleans to the West Indies, is to be submitted to American and Cuban lawyers and bankers, after which it is to be returned to the exporters for final approval.

Indictment Returned Against Cut Stone Contractors

The extraordinary grand jury of New York County considering the criminal evidence growing out of the Lockwood committee's investigation of the building industry in New York City on Jan. 25 handed down a blanket indictment involving certain members of the Bronx Cut Stone Contractors Association. The accused are charged with violation of the Donnelley anti-trust laws.

Roller Company Cited for Unfair Competition

Upon application for the issuance of a complaint the Federal Trade Commission has cited the Buffalo Springfield Roller Co., Springfield, Ohio, in complaint of unfair competition in the sale of road building machinery in interstate commerce. Public officials and employees of customers, it is set out in the complaint, are given gratuities by this company to influence the purchase of its machinery and expenses of inspection trips are paid.

Settlement Made in Newark Building Trade Dispute

Building operations in Essex County, N. J., halted two weeks ago when the lockout of 8,000 building trades employees occurred because of their support of journeymen painters in resisting a reduction in wages from $9 to $8 a day, were resumed Feb. 4. The agreement, which resulted in all building trades operators returning to work, is that the painters will receive $9 a day until Feb. 12, when a new agreement fixing $8 a day until April, 1922, will be signed. The other trades resumed work at the same wage they received before the lockout.